CHEMICAL & METALLURGICAL ENGINEERING

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CONTENTS FOR SEPTEMBER, 1936

Cost-Minded Chemical Engineers 461
An Editorial

German Industry Extends Friendly Hand to American Chemical Engineers 464
By S. D. Kirkpatrick

What Chemical Industry Means to America 468
Reprinted from *Factory Management and Maintenance*

Chemical Engineering Development and Training in Great Britain 470
By H. W. Cremer and H. J. V. Underwood

Tantalum Solves Corrosion Problem 473
By H. W. Paine

Flexibility Predominates in Design of Solvents Pilot Plant 474
By R. L. Taylor

How Filter Types Fit Into Process Requirements 476
By E. A. Alliott

Waste Lactose for New Lactic Acid Process 480
By T. R. Olive

Static Electricity Hazards in Solvent Handling 484
By J. T. Morris

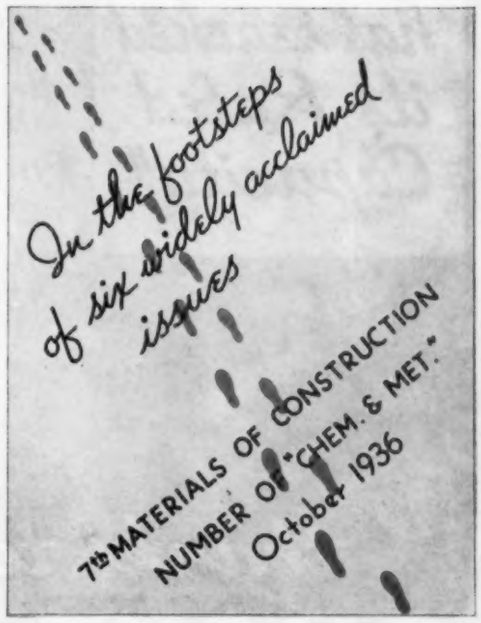
Viscosity Nomograph for Salt Solutions 485
By D. S. Davis

Carboys Carry Chemicals Safely and Economically 486
By R. W. Lahey

Stainless Steel Invades Laboratory 491

Chemical Engineering Congress Stresses Important Trends 492
Editorial Staff Report

Pittsburgh Meeting of A. C. S. Looks to Professional Development 494
Editorial Staff Report



WAY BACK in April, 1923, CHEM. & MET. made its first attempt to collect and correlate available information on corrosion-resistant materials. Then began a series of special theme issues—in April, 1923, July, 1924, October, 1926, September, 1929, September, 1932, and October, 1934—each of which carried forward this program, step by step.

Hence, next month, the reader will benefit from more than a dozen years of editorial experience in the cultivation of this important field. He will receive a veritable "Handbook of Corrosion, Heat and Abrasion Resistant Materials." Useful tabulations of physical and chemical data on metals and alloys, rubber and plastics, glass and ceramics, will be supplemented with timely information on important applications and developments.

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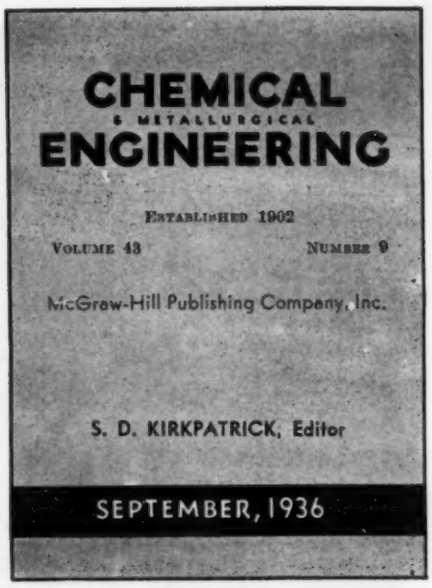


FOR COST-MINDED CHEMICAL ENGINEERS

WHATEVER OPINION one may hold as to the ultimate effects on chemical industry of the Robinson-Patman anti-price discrimination law, which was signed by the President on June 19, 1936, it is already becoming apparent that the act has implications that go far beyond the realm of marketing. Chemical engineers and production men may well begin to ponder over some of its provisions.

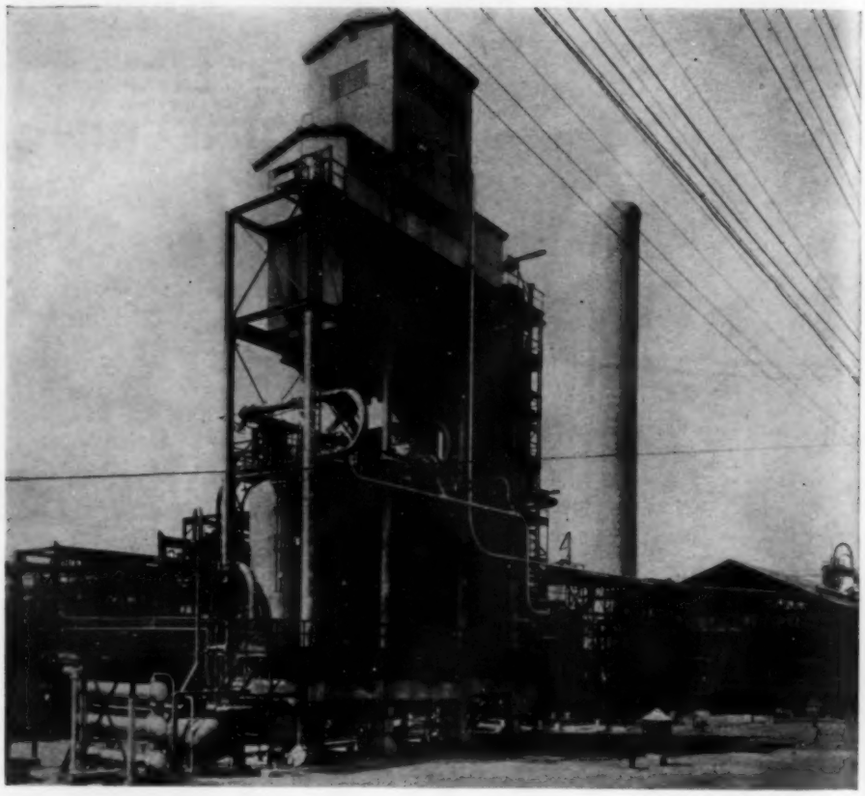
As we understand it, this disturbing legislation was enacted to protect the little fellow in the retail field against his big chain-store competitor, or in the words of its congressional sponsor—"to restore equality of opportunity in business without penalizing service and efficiency." No one would quarrel with that. But, unfortunately, as has been the case with other hastily drawn legislation of recent years, the means toward that end may actually defeat their purpose by upsetting normal channels of distribution and forcing uneconomic procedures in many other lines of industry. Some who have studied the measure hold that it might even have exactly the opposite effect than the one intended if a large buyer should claim and establish discrimination on the grounds that he had not been allowed sufficient discount as compared with the higher cost of selling to the smaller buyer.

It is this matter of costs that should now have the attention of chemical engineers and production executives. The Patman law defines one form of discrimination as failure to make "due allowances for differences in cost of manufacture, sale or delivery resulting from the different methods or quantities in which such commodities are to such purchasers sold and delivered." In another section the new act makes it a criminal offense to sell goods "at unreasonably low prices for the purpose of destroying competition or eliminating a competitor." Obviously some of these rather ambiguous phrases will have to await the courts' interpretation, but in the meantime it must be evident that cost accounting comes into a new significance. Production and distribution costs, varied to conform to a variety of marketing conditions, now become the legal basis for all future pricing policies.

This means that the man on the job in the plant has to know definitely what effect these changes in distribution methods, in packaging and shipping, transportation and selling, will have on his production costs. He must know the exact effect of changes in volume in relation to time and money. Furthermore, if he is wise, he will not stop with his own costs. He will study the entire problem because unless he knows all the factors in distribution as well as production, he may be neglecting one of these "due allowances" that the law vaguely defines as "discrimination."

For those few chemical companies that have not yet learned of the fallacy of withholding cost information from the men who are responsible for it, the new Patman law may have a salutary effect. Certainly we have come a long way since the days when such things were shrouded in mystery and secrecy. Cost-minded chemical engineering is today the industry's best insurance against trouble—whether from old-fashioned competition or "newly dealed" legislation.

FROM AN EDITORIAL VIEWPOINT



»Drought and Process Industry

PROCESSING of agricultural materials on a more extensive scale will stabilize agriculture. When and if America acquires the talked about "ever-normal granary," it will probably be in the form of stored, non-perishable, processed goods, rather than in huge stores of perishables kept Joseph-fashion, literally in granaries.

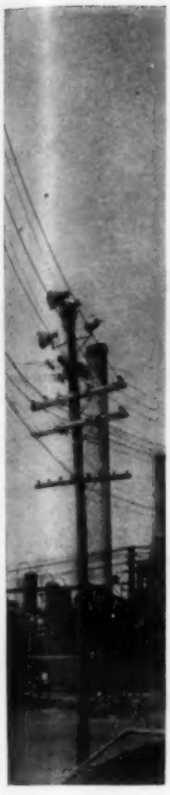
Drought conditions, recurring at frequent intervals over large areas, afford an opportunity and necessity for chemical engineering review of the facts. Obviously the national economy demands that agriculture intensify production at spots of minimum weather hazard. This may, probably will, give a distorted geographic relationship between producing points and markets. The greater gaps so created will best be bridged in some cases by processing of the raw materials nearer the points of production.

Generalizations are, of course, dangerous if pressed too far. But it does not seem unreasonable to suggest that even the chemical engineers in process industries somewhat removed from food and feed processing should give thought to these matters, perhaps with the prospect of profits for themselves and their companies.

»No Partnership Wanted

MUNITIONS makers of America—at least as far as chemical industry is concerned—require no partnership with Uncle Sam. They recognize, and will meet, their responsibilities whenever the Government needs production. They would very much prefer to produce materials for peace-time use. But they are adequately prepared and staffed to serve the country's needs in emergency with military supplies—in a business-like fashion, and without profiteering.

Many persons noting the close tieup between government and industry in Europe reason that America should do likewise. Such conclusion is not justified. American munitions makers, who are set up with potential capacity to serve in time of emergency, do not ask or wish peace-time



subsidy. This is particularly true of chemical makers. Nothing would be gained by having the Government give further detailed attention to the business affairs of these concerns. If there is need for cooperation in research or studies of new engineering designs the costs involved will be shared. But subsidy is not needed.

In Europe the situation is different. Over there many exotic establishments have been brought into being by subsidy because the governments interested believe the works essential to national defense. That is a matter on which there may be difference of opinion—even in Europe. But there need be no such uncertainty in America. Every essential industry can and will be established by private development and can be operated without any peace-time financial participation of Uncle Sam. Partnerships in these matters are not wanted for they sap at the very foundations of our technical progress.

» "Anti-Trust" Potash Inquiry

POTASH activities are to be investigated by a special subcommittee of the Senate, headed by Senator Key Pittman of Nevada. The industry is to be studied to determine whether price fixing or other monopolistic practices prevail, and to determine whether there is need for further federal legislation, presumably in the interest of the farmer.

Nominally the charge is that American Potash Institute is an improper agency of industrial cooperation. That charge seems to the well informed to be baseless. Apparently the claim is actually only a thin screen, poorly cloaking the desires of certain persons who wish to study questions of foreign ownership of American concerns and other factors affecting the development of potash in America.

The potash industry is in substantial measure a matter of public interest. Most of the development is on public lands, and much of it has been done with direct public aid in the exploration of the resources which are now being advantageously worked. Because of these factors of direct Governmental interest, there may be some justification for the question now raised as to who owns American companies which are benefiting from Government leases and Government research.

An interesting side issue is also involved. American Potash and Chemical Corp. works a patented area obtained from the Government in a section of Searles Lake, California. Some critics of the company claim that the operations are producing excessive drain of the brines of the lake, and that operation on a part of the area is in effect capable of depleting the entire brine reserve. It will be interesting to know whether, in a case like this, the courts will assume that reducing to possession of a fluid resource gives ownership control, as in the case of petroleum. If not, there will be some new legal principles required to define how great an area a miner of brines may drain without restraint. And if this principle applies to subsurface brines in the desert, why not also to subsurface brines in salt-well areas elsewhere in the country?

With a resource of this nature having great importance for the farmer, there is a natural, perhaps not altogether improper, desire on the part of public officials to know who has a right to determine prices and policies for American corporations. There need be no assumption of impropriety in the ownership, nor any presumption of law breaking in the orders that have been issued, to explain what is more than mere curiosity as to the foreign voting rights in these concerns. This, however, should not be presumed to justify any methods of inquisition or unbridled attack on an educational effort, such as that being made by the Potash Institute.

Chemical engineers will hope that Senator Pittman's specialists will regard their job as fact finding, and not dirt digging or mud slinging. The committee has everything to gain, and nothing to lose, by taking such an attitude itself when the actual hearings begin in Washington this Fall.

By SIDNEY D. KIRKPATRICK

Editor of *Chemical and Metallurgical Engineering*

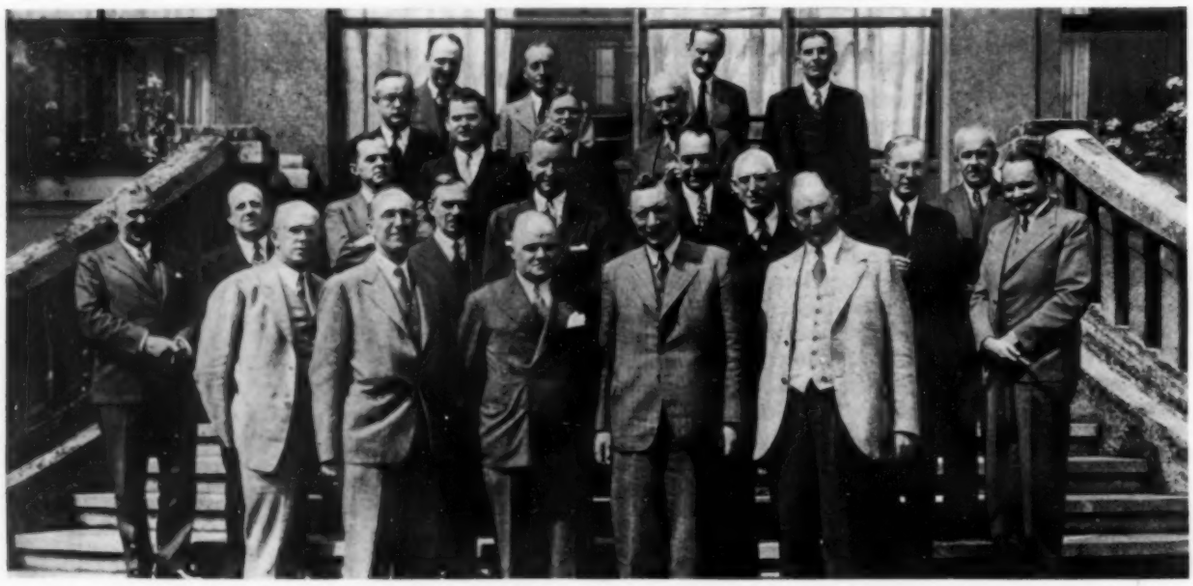
GERMAN INDUSTRY Extends a Friendly Hand to

LAST DECEMBER a group of about thirty chemical engineers, teachers, and industrialists came over from Germany to see the Chemical Exposition in New York and to spend a week in hurried visits to such chemical centers as Boston, Niagara Falls, Pittsburgh and Washington. This summer some twenty of us had the rare privilege of returning that visit and were received with such genuine welcome that we would like to share our experiences with the readers of *Chem. & Met.* Our trip was all too brief and hurried but in every plant we visited and in every chemical group with which we talked, we found the same friendly feeling toward American chemical engineers and industrialists. It seemed as if a chemical understanding between our two countries was long overdue. Perhaps, therefore, these two visits—relatively unimportant in themselves—may pave the way for a more friendly and realistic basis of future cooperation.

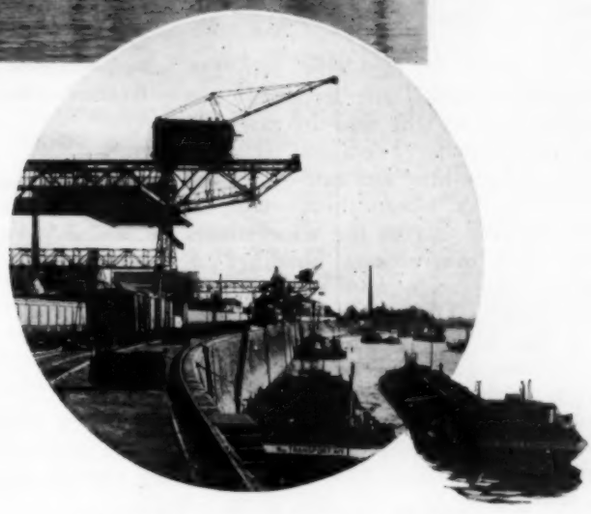
Our German tour had its start in Cologne on Sunday, July 12, when by pre-arrangement, a group of about 20 of the men who had attended the Chemical Engineering Congress in London and the Society of Chemical Indus-

American chemical engineers and their German hosts on steps of I. G. Casino at Leverkusen

Included here are Major Allen and P. S. Barnes of Pfaudler, R. I. Bashford, A. McClain, F. S. Pollock and J. T. Power of Atlas Powder, J. N. Compton of Carbide and Carbon Chemicals, R. L. Copson of TVA, G. F. DuBois of Monsanto, A. M. Fairlie, consultant of Atlanta, W. W. Farnum of U. S. Naval Powder Factory, M. H. Ittner of Colgate (president, American Institute of Chemical Engineers), W. N. Jones of Carnegie Tech, D. B. Keyes of Illinois, S. D. Kirkpatrick of *Chem. & Met.*, R. L. Murray of Hooker and George Oenslager of Goodrich.



American Chemical Engineers



View from the Rhine of the skyline at Leverkusen showing, below, facilities for unloading coal, pyrites and other raw materials.

try meeting in Liverpool (see *Chem. & Met.*, August 1936, pp. 413-23), re-assembled in the Dom Hotel, directly alongside of the famous old Cologne Cathedral.

The next day while the ladies of the party scattered out to see the sights and enjoy the rare privilege of shopping with 23-cent registered marks (that had the purchasing power of 40 cents each), the men visited the great I. G. works at Leverkusen. On the following day most of the party made the trip by boat up the Rhine to Mainz and then by train to Frankfort-on Main—an interesting old city which seems destined to be the chemical capital of Germany. After three days of receptions and plant visits in that city and its chemical environs, principally Darmstadt, Heidelberg, Ludwigshafen and Oppau, some of us entrained for Bavaria and points south. In Munich a profitable day was spent with Professor Albert Wolfgang Schmidt, president of the Technische Hochschule, who, incidentally, had been the leader of the group that visited the United States last year, and whose views on chemical engineering education were ably expressed in *Chem. & Met.* in May. And, finally for a few of us, the climax of the week came in a visit to that most remarkable Deutsches Museum of Science and Industry, with its large-scale exhibits of chemical processes and industries.

So much for the outline of the tour; now for a few of the details:

We See Leverkusen

Our party was off to a good start when four fine limousines picked us up at our hotel in Cologne and deposited us before the stately office building of the I. G. at Leverkusen. Up the marble stairs, passing by familiar statues of Robert Bunsen, Friederich Bayer and the late Geheimrat Carl Duisberg (Leverkusen's founder)—we were ushered into a beautiful auditorium, lavishly appointed and with a large map and flow-chart of the works directly in front of us. There we were met and welcomed by Dr. H. Kühne, member of the management (Vorstandsmitglied) of I. G. Farbenindustrie Aktiengesellschaft and Dr. Duisberg's successor as managing director of Leverkusen. His friendly greeting emphasized some of the common interests between our countries. He said, in part:

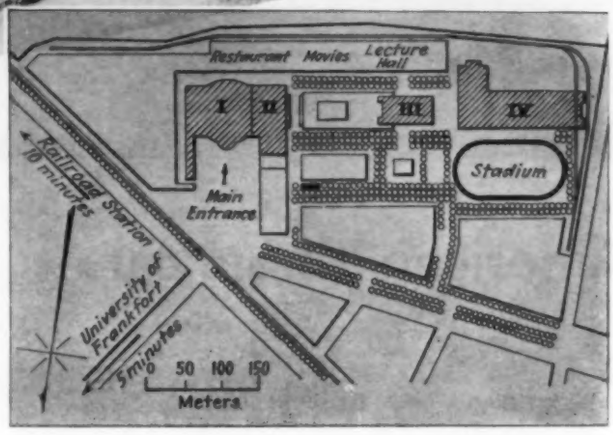
> If you as the representatives of the chemical industry and science of your country have come here to get better acquainted with our plant, we on our part would like to express the hope that such an acquaintance should, at the same time, be a personal approach and that new friendly relations might be created between us. Two such countries as America and Germany who have the most modern and most efficient chemical industries of the world must, in my opinion, never again renounce the mutual exchange of thought and ideas but should always find again and again in such an exchange, valuable suggestions and a constant enrichment of the soil of science.

Before describing the works we were to see Dr. Kühne presented some interesting facts about I. G. which is, of course, the largest German chemical concern. Altogether it employs about 150,000 men which is approxi-

mately 40 per cent of the total for the entire German chemical industry. Leverkusen is the administrative head of one of the five large divisions of I. G. and comprises, apart from Leverkusen itself, the works at Elberfeld, Dormagen and Uerdingen. It employs about 12,000 men, of which 3,000, including about 500 chemists and engineers, are office employees. Of all the pharmaceuticals and dyes sold under the Bayer cross trademark, 60 per cent are made at Leverkusen and the remaining 40 per cent at Hoechst, near Frankfort, and the Behring works in Marburg on the Lahn.

By means of the large map Dr. Kühne explained the layout of the plant, showing the flow of raw materials—principally coal and tar products, pyrites, lime and salt—from the Rhine docks where these materials are received, across the wide streets and into the various buildings in which the acids and intermediates are made. The whole plant is laid out like a city with beautiful trees and flower gardens between the buildings. Geheimrat Duisberg, we were told, always held that the psychological effect on the workmen of having these pleasant surroundings made for better housekeeping within the plant and promoted safety and pride of the men in their work.

Offices of I. G. Farbenindustrie at Frankfort-on-Main.



Exposition grounds where Germany's Chemical Show will be held in Frankfort, July 2-11, 1937.

As the tour started, each of us was given a copy of a mimeographed outline of the places to be visited and the party was divided into groups of six or eight, each in charge of a chemist or engineer who had studied or worked in England or in the United States. After a brief look at the large technical library, which includes the famous Kekule collection, we passed quickly through the various research laboratories and the technical dyeing and testing departments on out to the Rhine. Looking up this great river to Duisberg and Dusseldorf, important industrial cities of the Ruhr, we saw the river barges bringing in the coal of which approximately 200,000 tons are required annually. Pyrites imported from Spain is first roasted at Leverkusen for the SO_2, then returned to the Duisberg copper works for recovery of copper, silver and gold.

The acid plant, which we were next shown, is said to be the largest contact works in the world under one roof. It uses a vanadium catalyst. In an adjoining department for organic intermediates we were greatly impressed by the degree of specialization possible in an organization of this size. Entire buildings were given over solely to unit processes, such as nitration and sulphonation, which can thus be carried out on a scale that permits economical operation and control. The process equipment, while not the most modern in design, was well maintained and appeared to be giving efficient operation.

But the project that is Dr. Kühne's particular pride and joy at this time is a new power plant of unique design on which construction started in January and which was to have been completed in August. It will generate its power with steam at 135 atmospheres, approximately 2,000 lb. per sq. in. This is probably the highest pressure boiler installation in any industrial plant in the world. Although not quite as large as the installation at 32 atmospheres in the old power station, it has quite a number of unusual features. For example, there is no chimney as such, for in effect the building itself is all smokestack, rising perhaps 100 ft. in the air and literally packed full of efficient power generating equipment. Fired vertically downward with pulverized coal from about the second-story level, the tube-banks, economizers, air preheaters and heat exchangers extend to about the fourth floor. The flue gas then passes through a tremendous Cottrell precipitator which, with the forced draft obviates the usual necessity for smokestack. The turbines bleed steam for process use at 25 and 5 atmospheres. They operate at such extremely high speed, however, that they must be geared down to the generators.

An enjoyable luncheon followed at the company's Casino which is a large recreation center with well appointed restaurant facilities and social rooms, as well as apartments for employees and guests. The group photograph shown on page 464 was taken on the stairs leading out to the beautiful gardens of the adjoining estate of the late Dr. Duisberg. Here, too, are tennis courts, a large swimming pool and sports fields for employees and their families.

Finally, we were asked if there was anything else that we would like to see and someone (perhaps it was a distinguished Perkin medallist from Akron) suggested that it would be interesting to see the production of the new synthetic rubber "Buna," provided there was no objection on the part of the management. Dr. Kühne

quickly arranged a trip to the new plant, where we were shown the final steps in the process during which the polymerized product is milled and calendered, compounded and finally fabricated into samples for commercial testing. Tires and tubes made from Buna have demonstrated superior performance over those made from natural rubber although it must be remembered that economic values are measured with a different yardstick in Germany when the comparison is between an imported and a domestically produced commodity.

Germany's Chemical Capital

Frankfort-on-Main is noted for a number of things besides being the birthplace of the "hot dog" and of the great German poet, Goethe. For example, it is the headquarters of the three largest of the German chemical interests—the I. G. Farbenindustrie, the Deutsche Gold- und Silber-Scheidenanstalt (vormals Roessler) and the Metallgesellschaft and their many subsidiaries. It is centrally located with respect to the great chemical plants of the Rhineland and of Germany as a whole—Hoechst at Mainz, Badische at Ludwigshafen and Oppau, Leuna at Halle, Merck at Darmstadt, etc. Furthermore, since Frankfort will be the scene next July, of the great Achema VIII Exposition of Chemical Engineering Equipment and will be visited by at least 50,000 chemists, engineers and industrialists from all over the world, it might not be out of place to recall a few of the impressions and experiences we received during our three-day visit.

Our party was met at the Frankfurterhof, famous old hostelry, by Dr. Ferdinand A. Kertess, New York representative of the Deutsche Gold-und Silber-Scheidenanstalt and by the Hon. George Makinson and Sydney B. Redecker of the American Consulate in Frankfort. Later we were joined by Dr. Herbert Bretschneider, the enterprising leader of Dechema (the German Association of Chemical Engineering Equipment Manufacturers) and by Dr. C. Pretzell, formerly of the American I. G. and a neighbor in Summit, N. J. The Lord Mayor, Oberburgemeister Kreps, assigned a representative of the city architect's office to guide the party on a tour of the ancient city—through the famous Roemer, unique old town hall that for centuries before 1792 had been the scene of the elections and coronations of all of the rulers of Germany. Then came an official reception in the modern Rathaus by Dr. Mueller, president of the city council, followed by the opening of the city's wine cellars and a ceremonious sampling of some of the prize vintages that had been set aside by the city fathers for just such auspicious occasions. We were glad we came, especially so, when, as we signed the ancient city register, each of us was given a complimentary ticket to the Roemersberg Festspiele—a glorious evening performance of Schiller's classic opera "Fiesco"—staged in the open air in the ancient city square.

Dr. Kertess was host for luncheon for one large group that later visited cyanide and heat treating plants of the Scheidenanstalt. Another group attended a luncheon given by Dr. von Schnitzler, director of the I. G. in the great new office building that houses the executives and several thousand other office employees of I. G. headquarters. This beautiful reddish stone structure has the appearance of a large suburban hotel and in the center as one enters is an interesting exhibit of the myriad of I. G. products. Later in the afternoon the entire party re-assembled for a tour with Dr. Bretschneider to the Frankfort Industrial Fair and Exposition Grounds where the Achema VIII will be held from July 2 to 11, 1937.

These facilities at Frankfort will provide an ideal setting for what has come to be the most important showing of chemical engineering equipment on the Continent—and perhaps in the whole world. In addition to the four large buildings which will provide a total of 240,000 sq. ft. of floor space, there are spacious facilities for restaurants, industrial movies, reading rooms and lecture halls. Building I which has served as a large convention hall or auditorium and has a floor space of 85,000 sq. ft., will be given over to exhibits of scientific apparatus and instruments for measurement and control. Building II will house exhibits of equipment made from non-metallic materials—chemical stoneware, quartz, glass, silica, plastics and rubber. Building III is reserved for special process equipment for rayon, plastics and related industries. Building IV, largest of all—487 ft. long—will be used for large-scale apparatus and complete assemblies of process equipment for certain important chemical industries.

Dr. Bretschneider's enthusiasm for his project proved so infectious that many of us began to wonder if perhaps it would not have been better had we postponed our German trip until next year. But whether we can return or not, there undoubtedly will be many American chemical engineers and industrialists who will attend Achema VIII and benefit from its many interesting exhibits of processes and equipment.

On the two following days trips were made, individually or in groups, to inspect the I. G. plants at Ludwigshafen and Oppau, to Merck's and the famous Technische Hochschule at Darmstadt where Prof. Otto Fuchs is developing his courses in chemical engineering, to the 550-year old university of Heidelberg and to the hangar of the *von Hindenberg*. Unfortunately, these are stories that must be reserved for another time.

Offices of I. G. Works at Leverkusen.

What Chemical Industries Mean in Jobs and Wages

Establishments
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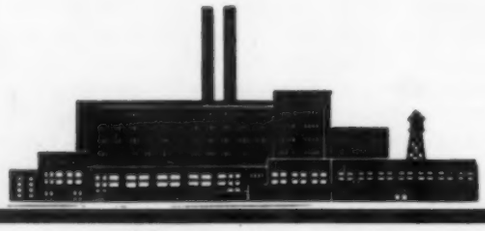


Value of Products
$3,702,672,063

Wage Earners
279,198

Wages
$351,984,157

Salaried Employees
123,387

Salaries
$201,355,972

Total Gainfully Employed
402,585

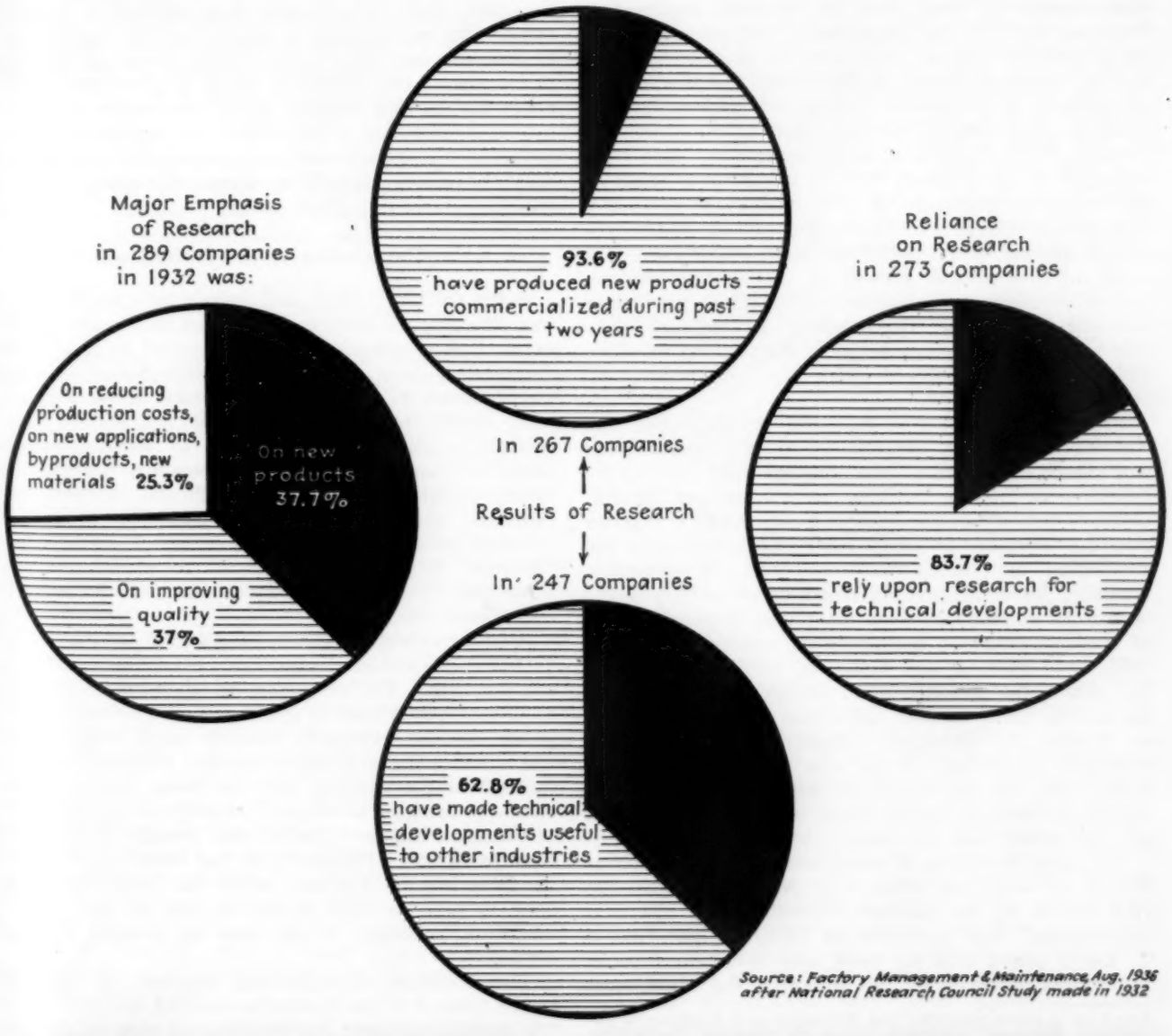
Total Payroll
$553,340,129

Source: U. S. Census of Manufactures figures for "Chemicals and Allied Products"

"WHAT INDUSTRY MEANS TO AMERICA"

¶ Typical of almost a hundred pages of unique, colorful charts and short, terse texts that have raised the August issue of *Factory Management and Maintenance* to a new high place in business journalism (see *Chem. & Met.* p. 406, August 1936), are these dramatic pictures of the parts played by chemical industries and by industrial research. Nowhere else has the story of industry's contribution to American life been told in such an effective and convincing way. Several key companies in chemical industry have already arranged for extra copies of the entire 425-page issue to be distributed to their supervisory personnel. Others are purchasing reprints of the editorial section which are being sold by the publishers on a sliding scale beginning at one dollar per copy. Typical of the almost universal acclaim with which this issue has been received, is Prof. Raymond Moley's editorial comment in the September 3 issue of *Today* in which he says: "*Factory's* review is worth a whole library of books on economics." We commend it for your study and use—EDITOR.

How Research Serves Industry


Major Emphasis of Research in 289 Companies in 1932 was:
On reducing production costs, on new applications, byproducts, new materials 25.3%
On new products 37.7%
On improving quality 37%
93.6% have produced new products commercialized during past two years
In 267 Companies
Results of Research
In 247 Companies
62.8% have made technical developments useful to other industries
Reliance on Research in 273 Companies
83.7% rely upon research for technical developments

Source: Factory Management & Maintenance, Aug. 1936 after National Research Council Study made in 1932

Chemical Engineering Development and Training in Great Britain

By H. W. CREMER and A. J. V. UNDERWOOD

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CHEMICAL engineering did not develop as a separate division of general engineering in the same manner as mechanical or electrical engineering. For many years it was a component, not yet consciously recognized, of various arts, such as the art of salt-making, of sugar-boiling, of distillation, and the like. Its recognition as a definite branch of applied science probably came about in the latter half of the nineteenth century, when its present name appears to have been coming into use in Great Britain, largely as a result of the rapid developments in the production of heavy chemicals on a large scale during that period. Emergence in this manner, to fill a definite need, rather than as a result of the natural growth of an already existing section of engineering, has had the effect of preventing chemical engineering from taking its rightful place side by side with cognate subjects, the training in which had long formed an essential part of professional curricula.

Possibly, however, it is the failure to appreciate that chemical engineering, like other sections of engineering, is a branch of applied physics that has most affected the development of the teaching of the subject in this country. For it has not been generally realized that the chemical engineer is much more concerned with the application of physics than with that of chemistry. Actually, he is mainly concerned either with physical operations entirely, or with the purely physical effects of chemical reactions, such as in the transport of solids, fluid flow, mixing and agitation, and heat transfer. To obtain the product of a chemical reaction in a marketable form further operations are involved, such as distillation, filtration, evaporation, crystallization, drying and grinding. These, also, are physical operations, and the indicating, recording and regulating appliances used to control them are usually based on *physical* rather than on *chemical* principles.

The tardy provision of educational facilities in Great Britain is surprising when it is realized that, in the introduction to his pioneer "Handbook of Chemical Engineering," first published in 1901, the late George E. Davis stated that the book was based on a series of lectures delivered by the author at the Manchester Technical School in 1887. Although the treatment of the subject was primarily descriptive in character, yet the view was quite clearly expressed that chemical engineering consists of a number of unit operations. It was left, however, to the United States of America to inaugurate the systematic study of these unit operations, and to that country is due the credit for establishing the teaching of the subject on an extensive scale, including the organization of research to elucidate the basic principles underlying chemical engineering and their applications to plant design.

Based on a paper entitled "The Education and Training of the Chemical Engineer," presented before the Chemical Engineering Congress of the World Power Conference in London, England, June 22-7, 1936.

Organization of the Profession

After the Great War, and largely as a result of our war difficulties, it came to be realized to an even greater extent that commercial success depended as much upon the careful study of plant, and plant design, as upon consideration of the actual processes to be used; in other words, profits could only be realized by sound chemical engineering. Moreover, to meet the more intensive competition, close co-operation between the more strictly theoretical and technical workers was essential; above all, it was realized that a class of business and financial men must be produced whose education was sufficiently broad to enable them to appreciate the sure foundation on which scientific conclusions rest.

A subject-group in chemical engineering of the Society of Chemical Industry came into existence toward the end of 1918. The profession of chemical engineering in Great Britain owes a great debt of gratitude to this group for the extremely valuable work which it did and is still doing in bringing together chemical engineers throughout the country, and for being largely instrumental in bringing about the formation of the Institution of Chemical Engineers, which was formally incorporated four years later. Previously, it had been suggested that the most important matter which the Institution would have to take in hand would be that of the type of education necessary to fit men to become chemical engineers.

The definition of a chemical engineer, as approved by the Council of the Institution in 1923, is as follows:—"A chemical engineer is a professional man experienced in the design, construction and operation of plant and

works in which matter undergoes a change of state and composition."

It will be realized that this definition is a very wide one, and that it is intended to include plant and works, not only for the chemical industry, but also for the important group of "process" industries. Also, a special significance lies in the order of the words "design, construction and operation," since this is regarded as the order of their relative importance. Skill merely in the operation of plant can be acquired by a good process hand or foreman, and, when the design is forthcoming, the construction of the plant can be safely left to the mechanical engineer, provided he possesses the requisite experience in the methods of fabrication involved, but neither construction nor operation calls for chemical engineering knowledge in the real sense of the term. It is in the actual design that knowledge of the fundamental principles of chemical engineering is needed, and, since an efficient design obviously implies familiarity with methods of construction and the problems met with in practical operation, both construction and operation may be considered as being included in design.

Shortly after the adoption of this definition, a syllabus of subjects was drawn up to serve as a basis for the examination for associate-membership of the Institution, and to serve as a guide to universities and technical colleges in arranging their courses and examinations in chemical engineering. This syllabus, with certain amendments, later appeared as part of a memorandum entitled "The Training of a Chemical Engineer," which became the official document of the Institution on this subject. A clue to the manner in which it was intended that this memorandum should be interpreted is given in the following words, which appear in the preface immediately following the above definition:—

> "A chemical engineer should not be, therefore, a highly specialized man, but rather one who possesses a thorough general knowledge of chemical reactions and physical laws, combined with a thorough grasp of the principles of mechanical and electrical engineering, and those branches of civil engineering dealing with the strength of materials and the theory of design and construction. A man so equipped should be capable of fulfilling the requirements of a chemical engineer."

There is no doubt that the memorandum has proved of considerable assistance to educational authorities and others, and that with suitable amendments and additions, introduced as a result of experience, it can be made to prove of still greater utility. Despite the careful thought devoted to the preparation of this document, however, and despite the fact that many firms concerned with the chemical and allied industries of the country were consulted and signified their approval of its contents, it cannot be said truthfully that even at the present time the real significance of chemical engineering as an educational subject is generally realized. For, notwithstanding all that has been spoken and written concerning chemical engineering education and the discussions which have taken place between representatives of pure and applied science, including both makers and users of chemical plant, agreement has still to be reached before the pressing needs of those who desire to train progressively and systematically for this profession can be satisfactorily met.

This fact is all the more inexplicable when it is realized that abundant evidence exists to show that industry in general is becoming more and more alive to the need for chemical engineers, yet the number of teaching institutions which are endeavoring to meet this need is at present disappointingly small. Moreover, with few exceptions, most educational authorities appear to have taken it for granted that chemical engineering must of necessity be an offspring of chemistry, with the result that it is taught either as a post-graduate subject following an Honors degree in chemistry, or in the final stages of a course of study, the earlier years of which have been primarily devoted to chemistry.

Broad Scope of Training

It would be ungracious not to accord to some of our schools of chemistry the credit for the establishment of these post-graduate courses, for such courses might not have been otherwise instituted. The academically-minded chemist does not always appreciate, however, the full significance of the term chemical engineering, and consequently tends to limit the scope of the training offered. It has been urged on more than one occasion, for instance, that all that is required is to give a ready-made chemist a "top-dressing" of engineering. Apparently it does not appear unreasonable to those who hold such views that the student in question shall spend the earlier years of his manhood forgetting masses of highly specialized chemical detail for which he never had, and never will have, any use, while at the same time he is endeavoring to acquire practical knowledge of fundamental importance in his every-day work at a time when he may have neither the leisure nor the requisite facilities for doing so.

On the other hand, it is equally unsatisfactory to attempt to superimpose a specially-designed course in chemistry upon a degree course in engineering. In this case the defects of such a system are perhaps less apparent, but a student cannot suffer the almost complete lack of chemical training during the second and third years of his normal engineering course without seriously impairing his subsequent effectiveness as a chemical engineer.

The authors have no intention to underrate the service to chemical engineering education rendered by the post-graduate schools, nor to disregard the excellence of much of the work carried out in them. Neither is it their desire to give the impression that the type of training offered is ill-suited to the needs of certain classes of work, for instance, in industrial research organizations where the responsibility for the main engineering work is in other hands. In such cases, the product of the post-graduate chemical engineering school can be of the highest value in co-ordinating the work of research chemist and engineer, quite apart from the contributions which he can himself make to the development of plant design and operation. Nevertheless, it is felt that the basic principles of chemical engineering and the other necessary branches of engineering must be inculcated at an earlier stage, if the academically-trained chemical engineer is to be rendered capable of exercising his full function in industry as a whole. It is profitable in this connection to bear in mind the official view taken by the American Institute of Chemical Engineers in 1922, namely, that "chemical engineering, as distinguished from the aggregate number

of subjects comprised in courses of that name, is not a composite of chemistry and mechanical and civil engineering, but itself a branch of engineering, the basis of which is those unit operations which, in their proper sequence and co-ordination, constitute a chemical process as conducted on the industrial scale."

Clearly, in view of what has already been said, there seems to be little, if any, justification for denying to chemical engineering what has been generally accepted in science, medicine, and in the other branches of engineering, viz., an undergraduate course, starting from the matriculation stage and culminating in an examination for a bachelor's degree.

In the opinion of the authors, the undergraduate course in chemical engineering should be organized as an integral part of a Faculty of Engineering, and not of a Department of Chemistry. Although this has not been adequately appreciated in this country (England), it follows logically from a realization of the difference in function, and consequently in education, between the chemical engineer and the industrial chemist, who would be quite properly trained in the chemistry department. In exactly the same way the electrical engineer receives his education in the engineering department while the industrial physicist receives his in the physics department.

Taking Time to Think

It is not proposed to discuss the question of pre-university education, save to emphasize the dangers of too early specialization in science as opposed to arts subjects. A good school endeavors to educate its pupils to think clearly and to write cogently, and to this end an early classical education has much to commend it. The over-emphasis of science subjects at too early a stage may indeed prove to be distinctly harmful, and there is little doubt that much of the lamentable weakness of many university graduates in expressing themselves is more directly attributable to this, than any other cause.

Of equal importance is the need for allowing the student during his college training time in which to think for himself. In many of the modern courses of study, with their crowded time-tables and their tendency to inculcate ready-made ideas without sufficient stress being laid upon the general background of fundamental natural laws, the average student rapidly loses all sense of individuality and even the desire for original thought, which it is the prime duty of a good teacher to stimulate. Chemical engineering, with its wide field and diverse viewpoints is an ideal subject in which to encourage the student to exercise his originality and initiative to the full, and any course of training should have this as one of its primary objects.

An undergraduate course for training chemical engineers should be based on a thorough grounding in mathematics, physics, chemistry and general engineering, chiefly mechanical and electrical, apart from specific instruction in chemical engineering.

In regard to any scheme for an undergraduate course, it must be emphasized that of equal importance with the scheme itself are the way in which it is administered and the mental outlook of the people who administer it. It is essential that the different parts of the course should be arranged in such a way that they form integral parts of a definite unified scheme, and are not merely a number of disconnected courses of instruction in the several individual subjects.

It has already been pointed out that the success of such a chemical engineering course will be vitally dependent on the personality of the man directing it. Breadth of outlook and substantial industrial experience are essential qualities required.

Importance of Proper Orientation

In order that a student should derive the maximum benefit from any course, however well it is planned and directed, it is essential that he should appreciate what it all means, and whither he is being led. If the student can be made to understand how the different subjects in his course are ultimately going to be useful to him as a chemical engineer, his interest and his progress will be considerably greater than if he has to study subjects when their main justification in his eyes is that he will at some time or another be required to sit for an examination in these subjects. It is highly desirable that, at an early stage in his course, the student should attend a short course of lectures designed to provide him with a brief survey of the field of chemical engineering and the functions and activities of the chemical engineer, with illustrative examples of some typical chemical engineering problems and the manner in which the subjects which he is studying are applied to the solution of these problems. In this way the student will be able to form a conception of the object for which he is striving, and the means which are necessary to attain it. The same principle could be usefully applied to training in other branches of engineering. It is desirable that this survey course, as it might be termed, should be taken at an early stage, at the end of the first year or the beginning of the second year, not only for the reason that the student should understand as soon as possible what he is doing and where he is going, but also because such a course will enable him to utilize better and derive more benefit from his vacation experience, which should begin at the end of his first year. This is again referred to, later.

It may perhaps help to make clearer what is intended by this brief "survey course" if a concrete example is given of the type of material included in it. For instance, any simple reaction carried out on an industrial scale might be dealt with. This, obviously, involves a knowledge of the chemistry of the reaction and physico-chemical questions of equilibrium, heat of reaction and rate of reaction. The removal or supply of heat, according as the reaction is exothermic or endothermic, brings in questions of heat transfer. The calculation of the time required to heat up the vessel and its contents requires mathematical methods of integration. The material of which the reaction vessel is to be made involves the study of materials of construction from the point of view of corrosion and possible catalytic effect on the reaction. The choice between two materials of different corrosion resistance raises the question of their relative lives and costs, and introduces economic factors. The design of the reaction vessel involves questions of mechanical engineering. Power will be required for stirring the vessel, and steam to heat it, or water to cool it, so that questions of power generation, steam generation and pumping, arise in conse-

quence. It may be desired to make the reaction continuous instead of discontinuous, which brings in the principles of physics involved in the use and construction of recording instruments and regulating apparatus.

The discussion can obviously be extended much further, but the brief description given above will show what is intended. At this stage of the course the student would merely be taught to appreciate the problems involved. The methods of solving these problems would only be discussed at a later stage. Thus, on the question of heat transfer, it would merely be pointed out that this is an important industrial problem, and that it is necessary to be able to solve problems connected with it. The actual study of heat transfer would be dealt with later on, when the basic operations of chemical engineering are treated in detail.

Many people responsible for university education will no doubt regard as revolutionary and intolerable the proposition, put forward above, that it is necessary and desirable to justify in the eyes of the student the effectiveness and utility of the course of training which is prescribed for him. The fundamental principle of scientific thought is a skeptical outlook and a refusal to take things for granted, and if this attitude is to be cultivated in the student, instead of becoming atrophied as so frequently happens during a university education, the student should logically adopt this attitude toward the course[1] which has been planned for him.

Apart from his academic training, the chemical engineer requires practical training and experience before he can be regarded as qualified. However efficient the academic training may be, the practical training is generally quite haphazard, depending very largely on the job which the young graduate manages to secure on leaving college. Opportunities of increasing his experience by a change of employment are much more limited than they were in the times before industry became concentrated into large groups as it is today, though there is a compensating factor where large firms provide a definite system of practical training. The practical training should not be postponed until after graduation, which would normally take place at the age of twenty-one or twenty-two. Contact with industry and with the realities of life should take place much earlier than this. There is much to be said for the system adopted at some universities, where engineering students are not accepted unless they have spent a year in the shops, although this system has the disadvantage of introducing a lengthy break between school and college.

Where some such system is not adopted, vacation experience becomes rather important. Following the completion of the first year, the summer vacation would be most usefully spent in systematic workshop training in the use of machine tools, coppersmith's work or welding. This would be best carried out at the university, or some other institution, in order to make the best use of the comparatively short time available. The same amount of time spent with an industrial firm would not give the same amount of technical experience, more time probably being spent in sweeping floors or fetching the foreman's beer, though even these humble occupations have definite moral value.

[1] **Editor's Note: In the original paper, which will ultimately be published in its entirety in the Transactions of the Chemical Engineering Congress of the World Power Conference, the authors have presented a detailed scheme of undergraduate instruction with outline of courses and curricula.**

Of the summer vacations following the second and third years, one should be spent in an engineering firm and one should be spent on a chemical plant, and some part of the time in a drawing office if possible. In this way, the contact with industrial life and broadening of outlook through human knowledge, responsibility and discipline will be just as important as, if not more important than, the acquisition of technical knowledge.

Tantalum Solves Severe Corrosion Problem

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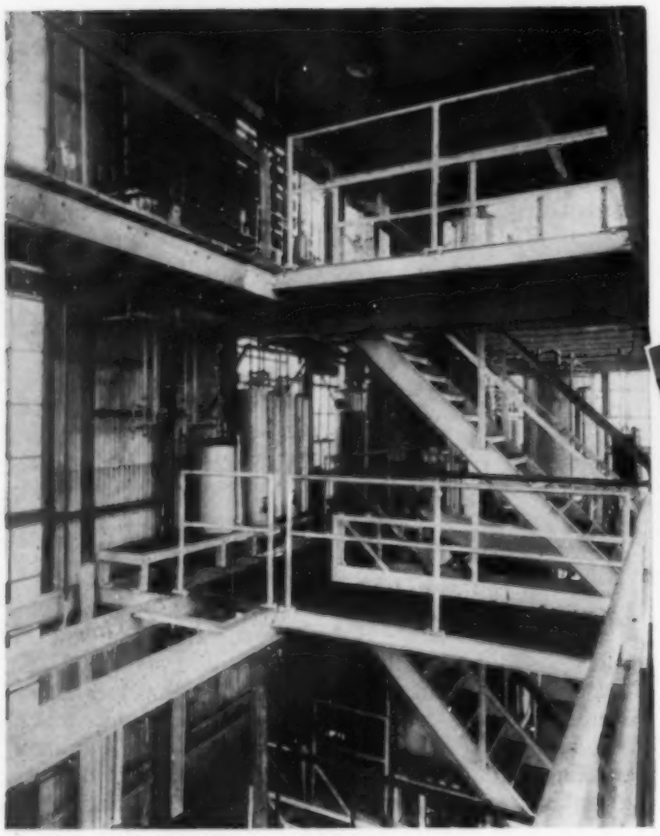
ONE of the newer processes for the treatment of pyroxylin (that described by R. K. Eskew in U. S. Patent 1,968,882 of August 7, 1934) involves some severe corrosion and contamination problems which have been successfully solved by the use of tantalum sheathing. In this process the nitrocellulose undergoes a combination of stabilizing, bleaching and clarifying. One stage of the process requires the use of a strong salt brine containing mineral acid, at a temperature of operation preferably somewhat above 100 deg. C. The corrosive effects upon equipment are correspondingly severe, perhaps chiefly as a result of the presence of nascent chlorine which is developed continuously throughout the process.

The usual practice of using wooden tanks in the purification of nitrocellulose is not feasible with this process not only because the wood itself will not withstand the chemical effects of the bath but also because extractive matter leached out of the wood by the liquor impairs the otherwise excellent color of the product. Experimentation with various ceramic materials resulted in the selection of acid-proof tiles and acid-proof cement which would withstand the chemical action of the hot liquor indefinitely, and a method was worked out for setting the tile lining in a steel tank so that no damage resulted from temperature changes.

There remained the problem of finding a material suitable for the steam inlet, the plug valves and the moving parts of the equipment, particularly a slowly rotating stirrer.

A pipe of ceramic ware for the introduction of the steam was felt to be prone to cracking as a result of such temperature changes. After some experimentation, a brass pipe lined and sheathed with tantalum was adopted for this purpose. The problem of the stirrer was ultimately worked out also through the use of a sheathing of tantalum. A sheet 0.012 in. thick was welded together over a stirrer of stainless steel. Tantalum was also used in the valve plug. It is believed that this technique may be of value in similarly severe problems in chemical industries involving corrosion of equipment or contamination of product.

Flexibility



Principal horizontal beams are drilled at 2-foot intervals to take additional cross-members as needed.

Steel walkways at three different elevations provide easy access to equipment.

FLEXIBILITY is the keynote observed throughout in the structural design of the Sharples Solvents Corporation's pilot plant and experimental building at Wyandotte, Mich. Built in 1933 to accommodate several small-scale experimental processes for making various amyl solvents, it saw one of its progeny grow so rapidly as to crowd out the others, with the result that it now houses a single full-scale production unit. By using structural steel members arranged in a simple plan providing for six vertical equipment wells in a 4-story framework, and by drilling the horizontal beams at 2-ft. intervals to take additional cross members as needed, it has been possible to accommodate five different rearrangements and enlargements of equipment leading up to the commercial unit which at present occupies the whole building. During the entire period of transformation it was not found necessary to relocate or replace any of the original supporting beams or alter in any way the general design of the structure.

The building rests on a concrete base, 21 ft. by 39 ft., and is 40 ft. high. Corner columns and the center column on each long side consist of 8-in. H beams, while 16-in. I beams serve as the principal horizontal members. Corrugated asbestos sheet fastened to the steel frame with metal clips makes a light and durable covering for the sloping roof. (See article "Chemical Plant Construction of the Present and Future" by Hurlbut S. Jacoby, appearing in the December, 1935, *Chem. & Met.*). Siding material consists of corrugated galvanized iron sheet, also fastened to the steel framework with iron clips. Generous areas of steel sash provide ample day lighting for the interior. The lightweight wall construction lessens the danger of serious damage in case of explosion, and this type of siding also can be removed easily when necessary to install or remove any piece of equipment that is too large for a doorway.

The general type and shape of the building were necessarily influenced by the fact that the work carried on inside would involve distilling operations to a large extent. In pilot plant distillation work the height of the column and condenser cannot be used as a criterion for determining the height of the inclosing structure as is the usual procedure in constructing a permanent production process. Varying uses of equipment necessitates frequent alterations in column height and condenser design. In the Sharples plant, flexibility is attained by the use of an elevation design which provides steel cross members at three different levels above the ground floor, thus providing a level for each of the four equipment units into which any distillation operation may be divided. On the ground floor are located reaction vessels and batch stills with vapor lines running to the base of rectifying columns on the second floor level. The fourth floor is used for condensers and weir boxes. Receivers and charging tanks occupy the third floor. After taking into consideration beam depth and overhead piping, the distance between levels was set at 9 ft. in order to give adequate head room along the walkways. In this way

Predominates in Design of Solvents Pilot Plant

By R. L. TAYLOR
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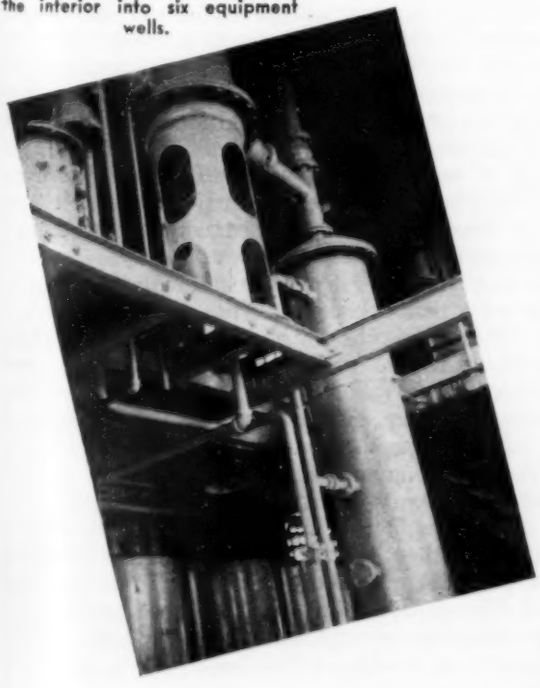
Pilot plant and experimental building of the Sharples Solvents Corp., Wyandotte, Mich.

the overall height of the building was finally determined. The system of confining a given type of equipment to a given floor level has been found to facilitate manual control and also greatly simplify installation planning when several processes are housed in one building and each is being altered from time to time.

The structural floor plan of the three upper levels consists of a symmetrical beam layout which divides the interior into six equipment wells. These are separated by a central steel stairway and walkway and two walkways running lengthwise of the building. A traveling overhead crane is used to hoist equipment up through the wells for installation on the upper floors. Another feature which contributes to the flexibility and adaptability of the structure is the fact that before erection all principal horizontal beams were drilled at intervals of 2 ft. to accommodate cross members for supporting equipment in the wells. When alterations are made or additional equipment installed, this not only eliminates error and extra work in joining the cross members to the principal beams, but it also speeds up the necessary design work by eliminating any question in regard to location of supports. The provision for standard spacing of cross members also eliminates any weakening of the beams that would be caused by the haphazardly located drilled areas that might easily result from a new placing of cross members for every change made in equipment location.

The floor plans consist of a symmetrical beam layout which divides the interior into six equipment wells.



The four outer wells were made 3 ft. wide by 17 ft. long. These provide space for columns or receivers up to 2½ ft. in diameter with sufficient clearance for flanges and piping. The two central wells were to accommodate the bulk of the equipment and so were made wider, the exact width finally being determined by the pitch of the central stairway, since it was desired for the sake of convenience and simplicity that the stairway just reach between the two main walkways of adjacent floors. The structural framework was designed for maximum beam loadings based upon the load equivalent of filling the center wells of each floor with water-laden standard 500-gal. tanks placed on end. This amounted to about 150 lb. per ft. on the central beams.

The walkways, in addition to providing convenient access to all equipment, serve as blinds to cover steam, water and gas headers. Leader pipes are run out from these headers as they are required by new equipment installations. A direct illumination system on each level is suspended from the walkway of the level above.

Since the erection of the building in 1933, when the first installation consisted of several experimental processes using only 100-gal. stills, 6-in. columns, and 37-gal. receivers, it has been necessary to make five complete rearrangements of equipment, with the result that 600-gal. stills are now being used, column diameters have increased to two feet, and receivers are now of 300-gal. capacity. The entire transformation has taken place with a minimum of structural changes, due principally to the fact that in the original design foresight was exercised in providing ample proportions and strength and in carrying out in every possible way the keynote of flexibility.

How Filter Types Fit Into Process Requirements

By E. A. ALLIOTT
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FILTERS that operate under a pressure greater than that of gravity may be classified into two general types, (1) those in which the liquid is forced through the filtering medium under a positive pressure, and (2) those in which the liquid is drawn through the medium by vacuum. Pressure filters include chamber and plate and frame filter presses; inclosed leaf filters; edge filters of the Stream-Line and Metafilter types; inclosed deep-bed sand and pulp filters; and finally, sterilizing filters using prepared filter pads. Vacuum filters are of three general types: simple false-bottom filter tubs or nutsches; tank type filters with leaves; and rotary continuous vacuum filters.

Filter Presses

The most universal types of pressure filters are the recessed plate and plate and frame types, more commonly called "chamber" and "frame" presses. These types are capable of such modification that designs can be produced to handle almost any type of filtration. Cake thicknesses range from, say, ½ in. up to 2–3 in. and more if required. A very large amount of filter surface can be packed into a comparatively small space. All kinds of passages can readily be arranged for feeding, draining, washing, heating or cooling the filter, and venting air from it. It is possible to make such presses in a large variety of materials, though wood and cast iron are the most common, and in these the capital cost per unit of filter area is extremely low. This makes these types most suitable for small and medium-size installations, but for really large outputs they are hampered by the time taken for cleaning, unless the material being handled is of a slow-filtering type, or requires very high pressure.

Chamber presses are suited to nearly all plain filtrations where washing is not required, unless it is desired to build up a very thick cake. Deep chambers are undesirable unless the plates are of very large size, because of the strain put on the cloth, which is forced into the recess by the pressure. Very thin cakes are readily made in chamber presses, but the average cake thickness in most cases is between 1¼-1½ in. Cakes thicker than this are usually regarded as special problems and are rarely found, for the reason mentioned.

The cheapest form of filter plate is simply fitted with an outlet spout, from which the filtrate runs into a trough, or, the outlet may be formed in an inclosed channel running all along the length of the filter, so that the filtrate is more protected from contact with the air, and can, moreover, be forced to an upper floor or storage tank without using an additional pump.

There are many reasons for using frame presses. First of all, the cloth lies flat on the plate and is not subjected to strain. Plate and frame presses are suited to thicker cakes than are chamber presses. They are, however, not well adapted to handle very thin cakes, say under 1 in. thick. The even thickness of the cake renders plate and frame presses particularly suitable for washing, and this suitability is further enhanced by placing the feed passages outside the cake itself, in the rim of the frame or in an external lug, an arrangement impossible in recessed presses. This prevents the wash water leaking so easily through the soft feed core, as it must do in the recessed type press.

The cake in any frame or chamber press can be washed by simply pumping water into the feed opening at the end of filtration. If the cake is solid all through, the water is liable to short circuit rather than penetrate the central strata of the cake. Good and speedy washing, however, can be obtained if filtration is stopped before the cakes are solid, but cleaning the press is then likely to be unpleasant unless the unconsolidated cakes form a clean layer on the cloth, and the feed is at the bottom so that the press can be drained. For this reason forms of "through" or "thorough" washing are generally employed.

In a perfect press the feed would be accomplished by means of external pipes with independent taps and hose connection to each chamber, while all filtrate, washings and air would leave by independent taps on each chamber, or by hose connections (fitted with sight glasses) to inclosed outlet pipes.

An interesting recent development in filter presses is the fitting of a permanent porous tile or stoneware covering to filter plates of more or less ordinary type, enabling them to be used without cloths. They are flexibly mounted on rubber molds, which are clipped on to the plates. To prevent the clogging of the plates and sticking of the cake to them, the tiles should be wet before filtration commences. This arrangement is very useful where ordinary cloths are rapidly destroyed.

It is often thought that recessed plate filters involve much labor, so that it is noteworthy that a 500-plate filter can be discharged and got going again in less than 2½ hours, four to five cakes being dropped per minute.

In operating on sewage sludge, eight large filters 52 in. square, each with 64 chambers, took a charge of

Abridged from Paper C9, presented before the Chemical Engineering Congress of the World Power Conference, London, June, 1936. Given under the auspices of the Institution of Chemical Engineers and the Chemical Engineering Group, Society of Chemical Industry, under the title of "Filter Presses."

4½ tons of pressed cake, with a total time cycle of two hours. The labor employed in this installation was: eight men on the press platform, four men on the trucks, one foreman.

Ten tons of linseed oil can be put through a 25½-in. square press, having 24 chambers, in an 8-hour day, the rate of filtration being approximately 2 gal. per square foot per hour. Pressures up to about 50 lb. per square inch are used. The procedure is to refrigerate the oil in order to break up the colloids, after which it is allowed to stand, decanted from most of the "foots," and then brought up to the normal temperature.

In working on intermediates, a 25½-in. square cast-iron press with external lugs, making 28 cakes, having an area of 224 sq. ft. took 5 minutes filtering, 30 minutes to wash and 3 minutes for air blowing. Emptying, cleaning and getting ready for restarting took only 12 minutes. This allowed for one man only most of the time. The cloths lasted 8 to 9 weeks.

Pressure Leaf Filters

The Kelly filter (probably the original inclosed pressure filter), has a cylindrical body and is made in large sizes. The filtering elements are leaves attached to the door which draw out with it on rails. Each leaf has its own discharge outlet, and an ingenious chain mechanism first causes the door to unlock and then opens the filter by drawing the door and its attached leaves out along the rails.

One of the best known and most developed large pressure leaf filters is the Sweetland filter. This consists of a long cylindrical cast-iron body, split horizontally, the two parts being hinged to one another. The closing gear is a particularly neat arrangement. A shaft extending the whole length of the filter is carried in bearings on the upper stationary portion, and has attached to it eccentric cams supporting a number of bolts and nuts which engage with slotted brackets on the lower hinged portion of the filter. Inside the press are mounted a number of circular leaves at suitable centers (from 2 in. up to 6 in.). These leaves each consist of a wire framework or drainage base which may be covered either with cloth bags or with Monel metal or other screens. The outlet, which is at the top, consists of a hollow shank which is pushed into a hole in the top of the press and secured by a nut. A hole in the side of the shank corresponds with a filtrate port which is led through a cock and a sight glass to the main filtrate outlet header. The inlet to the press is at one end, where a vertical channel in the upper portion faces a similar channel in the lower portion, from which the feed is led along a passage extending the whole length of the press bottom. A deflector plate is placed above this so that the flow is directed sideways between the press casing and the leaves. A very smooth feed is thus obtained. Often, and particularly in large presses for sugar work, these filters are fitted with a spray pipe by which the cake may be washed off the leaves at the completion of filtration.

Washing, in such presses, may be carried out either by simply following up the feed with water, or at the end of filtration the remaining liquid may be blown out of the press either through the leaves or by using the draining openings under compressed air. Wash water may then be introduced without mixing with the liquid to be filtered. It is most important, however, during all these changes, always to maintain a positive pressure within the press across the leaf surface so that there is always a little liquid or air passing through the leaves and holding the cake close to them. Failing this, some of the cake may drop off, causing difficulty during washing. Unevenness of flow due to broken or cracked cakes may be avoided by mixing with the wash water a small amount of already washed cake. This is carried to any points where excessive flow of wash water is occurring, and helps to fill up the cracks and even out the resistance of the cake. Practically perfect theoretical washing should take place in a filter of this type, providing the cake is of reasonably equal thickness all over.

The following data may be interesting as an example of the operation of the Sweetland filter when handling a free-filtering product such as barium carbonate, which had to be removed from a liquor containing Na_2S.

The body of the press was lead lined. There were 31 leaves, 33 in. diameter, at 4½ in. centers. 1,400 gal. of liquor (gravity about 18 deg. Tw. at 50 deg. C.) was pumped in in 10 minutes by centrifugal pumps at a pressure reaching 35 lb. per square inch, an average of nearly 23 gal. per square foot per hour. Two minutes was needed for draining before putting the wash on, and six wash liquors, each of about 600 gal., were pumped through the cake. For this a tank with six storage compartments was employed, five of which contained washings of decreasing strength from previous operations, while the sixth was pure water. Each wash was led back to the compartment following that from which it was taken, but the last and strongest wash went to the filtrate tank. The amount of fresh water per wash was therefore 600 gal. only. The pressure during washing was 48 lb. per square inch obtained by another centrifugal pump, and the time taken was 45 minutes, giving a rate of washing of about 13 gal. per square foot per hour. The wash water used was about 21 displacement volumes gross or 3½ net. This reduced the solubles to about 0.7 per cent on the dry cake, while bringing on the dilution of the final wash liquor to about 83 per cent of the original filtrate. Air drying took 10 minutes at 38 lb. per square inch, after which air at 10-20 lb. per square inch was used to discharge the cake from the leaves. 2,000 cu. ft. of air was used per operation (about 200 cu. ft. of free air per minute during drying and cake discharging). The labor, all told, was 1¼ man hours per operation. The wet cake weighed 5,400 lb. (about 100 lb. per cubic foot), and its moisture content was 32 per cent.

The Vallez is an inclosed pressure filter in which the leaves are mounted on a hollow central shaft which revolves at about 1 to 2 revolutions per minute. This enables a uniform cake to be built up from slurries which are by no means free-filtering, in which there is a strong tendency for selective settlement of the solids to take place, causing tapering cakes of uneven resistance to be formed in filters having stationary leaves. This much improves washing, which becomes practically a true displacement. This claim is said to be amply substantiated in sugar refining, and is one of the principal recommendations of the filter. In some cases it means that where the filter muds would otherwise be washed in separate filters, the whole operation of filtering and

washing may be carried out in a single filter with rotating leaves. The filter operates at pressures up to 40 lb. per square inch.

Edge Filters

With the advent of edge filtration, as exemplified in the Stream-Line filter, a distinct step forward was made. The Stream-Line filter consists essentially of one or more columns of specially prepared paper disks compressed together to form a filtering column or candle arranged within a pressure-tight body, or attached to a suction header. The inequalities of the paper surfaces cause extremely fine passages to be formed between the elements of the pack, so that when the liquid to be filtered is drawn through by vacuum or pressure, the solid matter is held at the edges of the pack, remaining upon the outer surface. No filter-aid is employed. The clear liquid passes upwards through the center of each column into the filter head. Each pack is mounted on a square rod, the space between the rod and the cylindrical hole through the paper disks forming a passage for the clear liquid. Each column of disks is compressed by a spring, which can be regulated to give a pressure suitable for the work in hand. When the elements are coated with dirt, and flow falls off, filtration is interrupted to permit compressed air to be blown in the reverse direction through the packs. The resistance of the packs is sufficient to confine this air sufficiently to insure that pressure is applied to each point on its outer surface, so that the cake is easily removed.

The filter body is usually cylindrical and may be surrounded by a heated water jacket. It is claimed that such filters will remove particles from oil down to under 0.000,004 in. in diameter. Such plant is particularly successful in handling used oil from gasoline and diesel engines, and in purifying transformer oils. The packs are said to last about a year in the hands of the average user. A medium-size filter is said to renovate engine oil at a cost of 2c. per gallon, including depreciation and maintenance, labor and electrical power at 2c. per unit.

A different use is made of edge filtration in the Metafilter, which has had a good deal of success in handling difficult clarification problems where quite small quantities of solids need to be removed. A number of metallic strips or rings is grouped together to form leaves or columns, the edges of which act as a support for a bed of filtering material which is precoated on to them before filtration proper is begun. The advantage of this class of filter is that a very firm support is provided for the filtering bed or precoat, which is held firmly and is rarely liable to slip during filtration, while the elements themselves again offer sufficient resistance to distribute backwashing pressure properly over the surface, enabling the deposit to be readily forced off the leaves when required. Filters of this class depend on the filter bed and are not ordinarily employed where a large quantity of cake must be built up, with large additions of filter-aid to maintain free-filtering qualities. They may, however, be very effective where very fine filtration is required, but the amount of actual cake deposited is small. Metafilters are used for syrup filtration, gelatine, transformer lubricating and fuel oil, etc. A special ring filter is made for varnish.

Another type of pressure filter may be referred to as the deep bed type. Sand filters are a well-known example. The action seems to be that true surface filtration goes on for a time until the pressure rises sufficiently to force that layer into the bed and another one is formed. This proceeds until ultimately the filter ceases to run clear. When the bed becomes choked or ceases to run clear, it is cleaned by pumping an underflow of water through it, agitating the sand and washing out the accumulated particles away to the drain. Such sand filters are practically limited to water filtration.

Another type of deep bed filter is the pulp filter, which at one time was generally used and still is in use for filtering beverages in order to polish them and give them brightness. The advantage of this type of filter is that the filtering material can be used again and again if it is suitably washed. The cakes are formed in a small pneumatic press.

Filters having prepared pulp leaves are finding increasing application. The Seitz sterilizing filter is especially popular. These filters use ready prepared "films" of cellulose fiber or a mixture of asbestos and cellulose, which are simply placed between the filter elements and thrown away when done with, so that no washers are needed. The films are thick enough and fine enough to stop the passage of yeasts and other organisms, including bacteria such as *B. prodigiosum*.

Such filters find their special application for liquids from which all traces of organic life must be removed without heating. The fineness of straining is effective down to about 0.8μ or, say, 1/30,000 in. This depends a little on the type of bacillus, since a long motile, flexible type will pass more readily than one formed like a short, rigid rod. Smaller filters of this class are used for handling serums, antitoxins, liver and other extracts. Larger filters are used to treat all kinds of beverages and juices. A large filter of this type is a double-ended press having 80 filter pads (or films) on each side of a central, double-sided, fixed head. The filter plates are of a special bronze or light metal, half serving as inlet leaves and half as outlet leaves.

Vacuum Filters

We may now pass to a consideration of vacuum filters. The most common form consists of a plain tank in which a support has been placed for a false bottom carrying a filter surface and filter cloth. All that is necessary is to connect the outlet from the bottom of the tank to a receiver for the liquid, and a vacuum pump. The slurry is run in, drained, and the solids dug out. Such a filter will serve excellently for such materials as caustic mud and whiting, in fact for any material which is fairly concentrated and which will build up a good cake several inches deep. There is little to be said about such filters, and their mode of operation will be easily understood.

For larger scale work the Moore type filter can be used. In this, leaves, hanging from a header, are suspended in a tank containing the liquid to be filtered, which is drawn through the leaves by vacuum applied through the header. When enough cake has been formed the leaves may be lifted out by a crane and placed in a washing tank. After washing, air is blown back to discharge the cakes. In the Butters filter all the work is done in a single tank.

When large quantities of products capable of rapid cake building are to be handled, continuous vacuum filters of the rotary type are generally employed. In these a large drum is arranged with filter elements round its periphery, these elements communicating with a space under reduced pressure. The rotary vacuum filter is commonly supposed to have been an American invention, and it is true that it was developed there on a large scale during and just after the war years, mainly for mining purposes. Nevertheless, rotary filters were used in Great Britain in alkali production at a very early date, and, in another field, the writer has seen, at Paisley, a pair of rotary filters which have been some 40 years or so in use for treating starch. (Numerous U. S., British, French and German patents were issued covering continuous vacuum filters in the period 1870-96. It is generally believed that the first commercially successful design was that of Solvay, 1896.—EDITOR.)

The surface of a modern rotary filter is divided into sections which are placed under suction, while they revolve through a tank containing the material to be filtered. They are maintained under suction as they emerge from the tank, when they are usually subjected to washing by means of spray pipes. After this, air is drawn through the cake in order to dry it as far as possible, and finally each section comes opposite the knife or "doctor," which scrapes the cake off. During this process it is usual to subject each individual section to a blast of compressed air in order to free the cake from the cloth. The heart of this arrangement is the rotary valve, by means of which the outlets from the sections are connected, first to vacuum through a port connecting to a filtrate receiving tank, then to vacuum through another port connecting to a washings receiving tank, which usually serves also for dryings. There is also a port for compressed air.

The slurry tank is generally provided with an agitator (paddle or oscillating) to keep the mud from settling. The filtrate and washings are drawn to separate receiving tanks connected to a dry vacuum pump. The filtrate or washings are withdrawn from the bottom of the tanks by centrifugal or other forms of rotary pumps. It is not unusual to arrange these tanks with a float or trip device so that if they become unduly full the vacuum is broken in order to stop liquid being carried out through the vacuum pump, which alternatively is sometimes protected by a barometric tube. The washing arrangements in such filters are comparatively simple, consisting of perforated pipes or sets of sprays arranged across the filter towards its top. The filter drum may have a cast-iron or a wood periphery, divided into sectionalized chambers. In large filters, steel construction is sometimes used. These chambers support the filter cloth, which may be of any convenient kind. It is usually laid on and bound into place by turns of wire. This wire also serves as a support for the scrapers, preventing their coming into close contact with the cloth. A more recent practice is to divide the cloth also into sections, each section being tamped into place, a device which improves the ease with which the filter can be reclothed.

The following example of the operation of a modern rotary filter dealing with caustic mud may be instructive. The drum (5 ft. diameter, 4 ft. 6 in. wide) is made of cast iron and clothed with Monel gauze. The filter area is about 70 sq. ft., and the speed approximately 1½ r.p.m. The vacuum pump displaced 160 cu. ft. per minute (about 2½ cu. ft. per square foot filter area), the vacuum under normal working conditions being about 15 in. The nearly boiling slurry from the causticizer was fed to the filter immediately after causticization was complete, without any settlement. The cake on the drum was thoroughly washed with hot water in the form of a spray in order to reduce the Na_2O content to 0.5 per cent calculated on the bone-dry cake. Depending on the class of lime used, the filter, working on hot caustic slurry containing about 10 per cent by weight of solids, gave per square foot per hour: 25 gal. of mother liquor (20 deg. Tw.), 2½ gal. of recovered wash liquor (17 deg. Tw.), and 28 lb. of bone dry filter cake. The moisture content of the thoroughly washed filter cake as discharged from the drum of the filter was about 35 to 50 per cent. Power requirements totalled 13 b.hp. No extra labor or attention was required, as the man in charge of the causticizer was also able to attend to the filter.

With higher concentrations of the slurry, higher yields per square foot are obtained in some plants, so that with caustic slurries containing, say, 25 per cent solids, with perhaps a somewhat larger vacuum pump, the output might be 56 lb. or more per square foot of filter, depending a good deal on variations in local conditions.

Cake Compacters

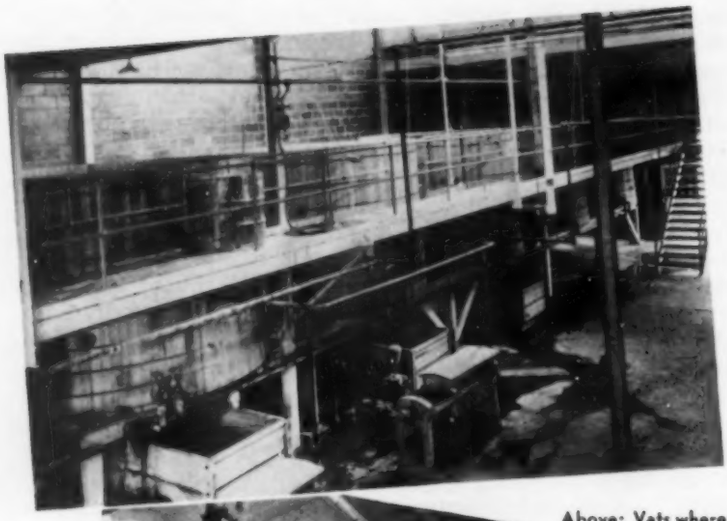
A difficulty occurring in rotary filters is the cracking of the cake during drying. This allows air to leak, reducing the vacuum and hindering drying. In order to prevent this it is usual to fit a number of rollers towards the top of the filter, to squeeze the cake. A wide canvas band is sometimes stretched over these rollers in such a way that it presses on the upper surface of the filter cake, helping any cracks to close up.

Another form of rotary filter consists of a number of disk-like leaves fixed to a single revolving shaft, each disk dipping into a trough. The wheels are built up of radial fan-like sections, each of which is independenly clothed and connected to the vacuum main. This arrangement is very helpful where large amounts of filter surface have to be put into a small space. It is best suited to problems in which no washing has to be done, since the face of the cake is vertical and, in consequence, does not hold wash water very readily.

Some slurries contain particles which settle so rapidly that it is difficult to get them to adhere to the filter. Filter drums made with internal filter surfaces are intended to deal with this difficulty. The Burt filter was an early example of a batch filter operating on this principle. A modern development of this idea is the Dorrco filter, which operates continuously under vacuum. It is in effect a rotary vacuum filter turned inside out, so that the product to be filtered is led into the hollow interior of the drum, which is fitted with sectionalized filter elements connected to a rotary valve in the ordinary manner. One end of the drum is open to admit a conveyor, which receives the cake from the upper part of the drum as it is dislodged by an internal scraper.

Another way of dealing with the difficulty is to employ a top feed, with a drum having an external filtering surface of the usual type.

Waste Lactose

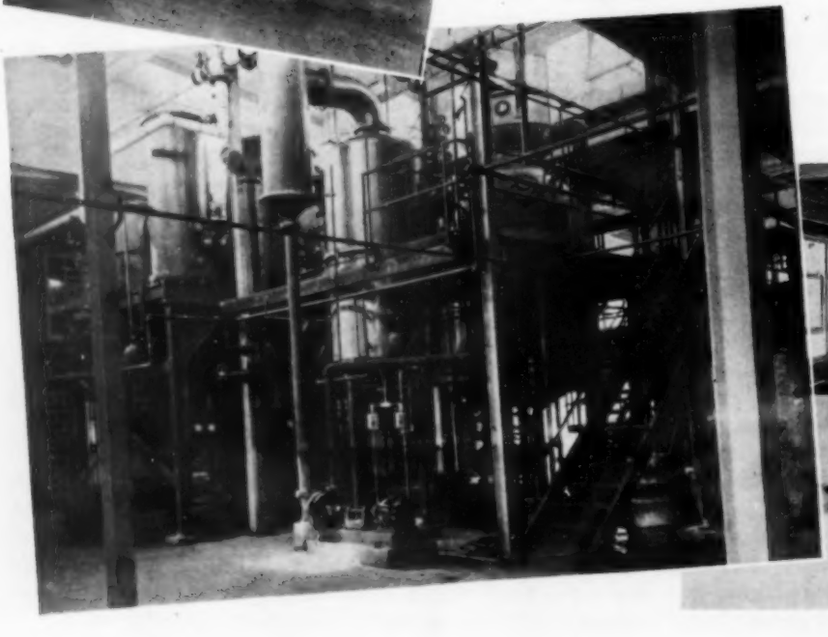


Above: Vats where whey is fermented, together with storage tanks and filters for removing albumin and activated carbon

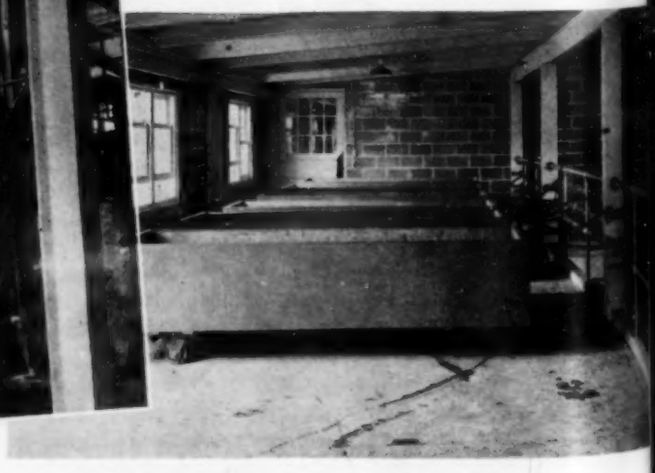
Left: Double-effect evaporator used for initial concentration of calcium lactate solution

Below: General view of evaporators with double-effect evaporator at left, stainless steel pan in center and copper pan at right

Lower right: Stainless-lined, portable crystallizing pans for calcium lactate, connected to cooling water line on gallery above the centrifugal



ONE PHASE of the assistance that the farmer is receiving from chemistry and chemical engineering, to which little attention has been given outside governmental agencies and the industries immediately involved, is the production of chemical materials as byproducts of the dairy industry. Probably the most active of the organizations in this field, and certainly the one that has shown the most interesting results, is the Sheffield By-Products Co. of Hobart, N. Y., a subsidiary of Sheffield Farms Co. and, in turn, of National Dairy Products Corp., of New York. Under the active direction of its manager, F. L. Chappell, who is personally responsible for most of the advances that have been made, the By-Products company a number of years ago went into the production of casein, crude and refined lactose and albumin and has, within recent weeks, at its Norwich, N. Y., plant commenced operation of a full-scale unit utilizing the lactose content of surplus whey and manufacturing both the technical and U.S.P. grades of lactic acid, calcium and sodium lactates. Capacity of the new plant is estimated at about 10,000 lb. of 22 per cent lactic acid per day, or its equivalent in other lactic products. Space



Is Raw Material for a New Lactic Acid Process

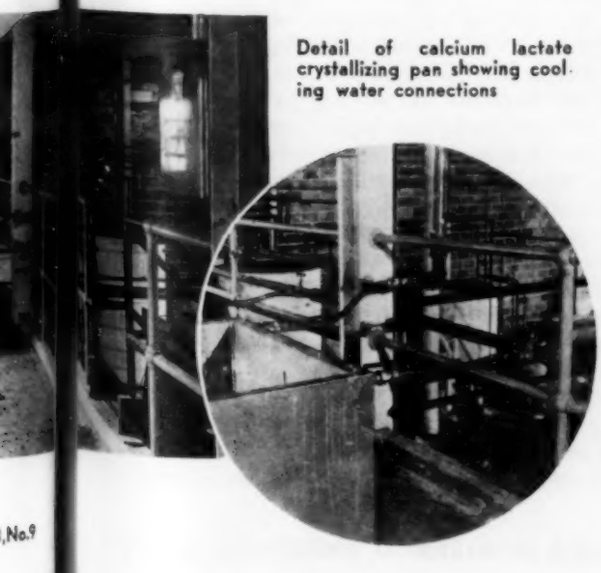
By THEODORE R. OLIVE
Associate Editor, Chem. & Met.

has been provided in a new steel and hollow tile building for doubling this capacity whenever demand has increased sufficiently to require it.

This venture is interesting not only because it presages new profits for the farmer from "below the cream line," as Mr. Chappell describes it, but because it represents, so far as is known, the first commercial production of lactic products from milk sugar. Despite the seasonal character of the business, despite a considerable foreign import and a stable domestic production from other sources (chiefly molasses and starch), Sheffield's process has been introduced at a cost of over a quarter of a million dollars, and with results that seem to assure commercial success. For the new products are equal, if not superior to those from other sources, the acid, for instance, being a water-white material so free from impurities that it is almost entirely lacking in the characteristic lactic acid odor. From the economic standpoint, this utilization of a formerly almost worthless waste material will doubtless exert a stabilizing influence in dairying that cannot fail to react to the benefit of American agriculture.

To understand the position of chemical byproducts in the dairying picture, it is first necessary to glance briefly at the character of undertaking involved in a large milk business. Milk is a highly seasonal product, the output of which increases sharply as the herds are turned into summer pastures. In order to protect its winter supply, a large dairy concern must contract for the entire output of a sufficiently large number of cows, regardless of the fact that this means a large surplus of milk during the summer months. It is, therefore, necessary to seek outlets for the summer surplus as well as for the skim milk, from which the cream sold as such has been removed. To some extent these surpluses can be disposed of for feeding purposes, but present trends indicate the need for more efficient utilization.

As an example of Sheffield's own surplus milk problem, the 1935 figures may be quoted. With a total of 598,940,000 lb. of surplus milk during the year, the company used 198,790,000 lb. for evaporated whole milk and 52,900,000 lb. for whole milk cheese. At the same time, 189,000,000 lb. of skim milk went into casein production and 75,600,000 lb. to skim milk powder, while 82,650,000 lb. of skim milk was sold as such. Smaller quantities of surplus were employed for other non-chemical purposes.



Detail of calcium lactate crystallizing pan showing cooling water connections

Milk as Source of Chemical Materials

Milk is an emulsion of butter fat in a solution of colloids and crystalloids, comprising on the average about 4 per cent fat; 3.3 per cent protein (of which 75-80 per cent is caseinogen, the balance largely lactalbumin); 5 per cent lactose; and 0.7 per cent inorganic salts in large variety. Its utilization for chemical purposes calls for a thoroughly fat-free skim milk which, on acidification, yields a coagulum of casein and a whey containing the lactose, lactalbumin and inorganic salts. The improved, fully mechanized casein process developed by Sheffield has previously been described in *Chem. & Met.* (December, 1934, pp. 644-6). Of the whey produced in the five casein plants now operated by the company, a rather small percentage has been treated for the recovery of refined lactose, yielding as a byproduct a crude albumin which has been mixed with lactose washings to produce a trademarked chicken feed. A much greater part has been evaporated to a crude lactose (whey powder) which has also been disposed of for feeding purposes.

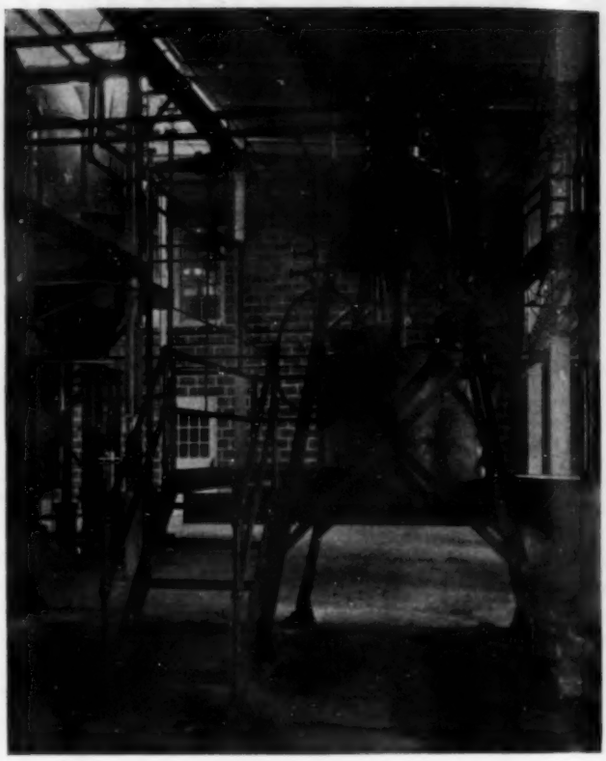
Nevertheless, despite these markets, it has not in the past been economical to work up the bulk of the whey into useful products and it has been necessary to waste it. This low value raw material, then, rescued from the sewer, is the one that forms the basis of the new industry, at one and the same time cancelling a former economic loss and eliminating a waste disposal problem.

The new process stems from work initiated several years ago by the Bureau of Dairy Industry, U. S. Department of Agriculture, which, under Dr. L. A. Rogers, chief of the Division of Dairy Research Laboratories, and his associates, made a laboratory study of the continuous production of calcium lactate from whey. The

methods developed were in many ways similar to those now used by Sheffield. Starting from these earlier results, Dr. S. M. Weisberg of National Dairy's Baltimore Laboratories supervised the further development of the process which was eventually transferred to Hobart where it was carried through the semi-works stages under Stoddard Stevens, By-Products company chemist. Investigations now being conducted by the Bureau are seeking to put the original continuous process on a commercial basis.

Experiments by the Bureau had shown that a fermentation process employing casein whey as a medium and a mixture of a lactobacillus such as *L. bulgaricus* or *L. casei* and a mycoderm (associated type of fermentation bacterium) was ideal for lactic acid production. It is, however, a characterisitc of fermentation reactions that an equilibrium is always reached, generally at a relatively low concentration of product, at which the bacterium ceases to be active. Removal of the product or its conversion into some non-active compound is consequently necessary in obtaining exhaustion of the medium. For this purpose the Bureau employed continuous additions of hydrated lime or calcium carbonate, so that the product was first isolated as calcium lactate rather than as lactic acid. By this means, yields as high as 90 per cent were obtained during operation on a semi-plant basis.

When Sheffield undertook to adapt the process, it was found that continuous production was less advantageous than the batch method generally employed in fermentation. Customarily, in fermentation processes, it is necessary in growing a culture to transfer it at certain intervals into larger and larger portions of the medium, thus avoiding the stagnation which eventually takes place in the process. The Bureau's continuous method obviated this need, since, in effect, it was equivalent to infinitely rapid transfer and thus maintained the culture always in its most active phase. On the other hand, for plant purposes, side reactions were found to be more readily avoided by the conventional method which consequently was the one adopted.



Hepworth centrifugal used for separating and washing mother liquor from calcium lactate crystals

How the Process Operates

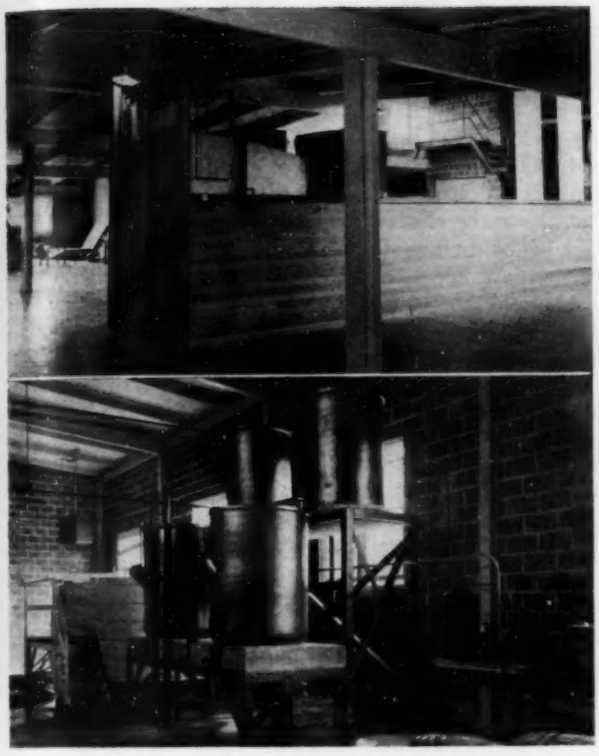
The lactobacillus employed, which is *L. bulgaricus*, plus a mycoderm, is started in the laboratory, using as a culture medium pasteurized skim milk in which the ferment is grown at a temperature of 110 deg. F. From the laboratory flasks the culture is inoculated into sterilized 40-qt. cans of pasteurized skim milk and these are used to inoculate sterilized 700 gal. glass-lined steel tanks of raw whey. Finally the contents of two of the glass-lined tanks is added to enough whey to make up 5,000 gal. in one of the five 7,000-gal. agitated wood vats which are the final fermenters. As in the growing stages, the fermenters are maintained by steam coils at 110 deg. F. A period of 48 hours is required in working up the contents of each fermenter.

It is during this final fermentation stage in the main fermenters that liming is accomplished. The lime is added as a slurry after fermentation has been in progress for about eight hours. Four subsequent limings are also made to prevent the lactic acid concentration from increasing beyond about 1.3 per cent. A total of 900-1,000 lb. of lime is required per fermenter batch, a slight excess being added at the end of the fermentation to bring the product wholly into the form of calcium lactate. The batch is then heated to 190 deg. F. to coagulate the lactalbumin and permit its removal by settling and decantation. After the boiling period, the tank is left to stand until the coagulum has settled, whereupon the clear supernatant liquor is drawn off to a storage vat by means by a swinging decanting pipe. The settlings are passed through a filter press, the solids discarded and the filtrate returned to the storage vat where it is treated with an activated carbon, together with the overflow fermentation liquor. The carbon is then removed by filtration and the decolorized solution, still containing the inorganic salts of the original milk, goes to a double-effect Buffalo Foundry evaporator where it is concentrated to 10 deg. Bé. under a vacuum of 19 in. in the first effect and 25 in. in the second effect.

This same evaporator is used for the concentration of surplus whey not required for making lactic acid, when this material is to be worked up into whey powder.

The evaporator is a modern high-velocity type employing a vertical tube heater joined to a separate vapor body for each effect. High liquor velocity is obtained by the use of suitable tube proportions, without the necessity for a circulating pump. Vapor from the second effect is condensed in a jet condenser which is discharged by a turbine-driven centrifugal pump because of insufficient headroom for a barometric leg. A small steam jet is used as an air pump. The particular reason for employing this type of evaporator lies in the accessibility of the heating surfaces for cleaning.

In addition to the double-effect, two single-effect evaporators are provided for continuing the evaporation.



Tunnel air dryer for calcium lactate
Stoneware vacuum filters for lactic acid

Either one of these may be used. One is a large copper pan built by Mojonnier Bros. Co. of Chicago and the other a stainless steel evaporator heated by tube coils and constructed by Bauerle & Morris, of Philadelphia. When the solution is to be finished as calcium lactate, it is evaporated in one of the single-effect pans to 15 deg. Bé., but if it is intended for acidification and lactic acid production, the evaporation is carried on to 20 deg. Bé., to permit making a 22 per cent acid.

When the product is to be finished as calcium lactate, the 15 deg. Bé. solution is pumped from the final evaporator to a number of portable water-cooled crystallizing pans placed on a gallery above the evaporator floor. There are six of these pans, each a double-walled box of about 300 gal. capacity with the inner wall of stainless steel ply metal. Cooling water inlet and outlet hose connections can readily be made to the boxes at one point along the gallery rail. Baffles within the jacket insure effective circulation of the water. After cooling and crystallization, each crystallizer in turn can be wheeled to a point on the gallery above a Hepworth centrifugal on the main floor level, and its contents shoveled out and down a chute to the centrifugal basket. After whizzing the mother liquor is returned to the fermenters, together with the wash water used, while the crystals are then dried forthwith, if the product is to be of technical grade, or subjected to further purification for the production of U.S.P. lactate. The purification for the one-run or technical grade, it will be noted, consists in the removal of the protein matter by coagulation and filtering, decolorization of the solution with activated carbon, followed by a final washing of the crystallized product in the centrifugal. For the U.S.P. grade, the technical lactate is dissolved in water, agitated with more activated carbon, re-filtered, re-evaporated, re-crystallized and finally washed again, producing a grade which in all particulars meets the U.S.P. requirements. Crystals of either type as finally produced are loaded into dryer trays, placed in trucks and dried in a tunnel air dryer using filtered air under accurate temperature control. The dry crystals are then packed in barrels of 200 lb. capacity, ready for shipment.

That part of the product which is to be finished as lactic acid is, it will be recalled, concentrated to 20 deg. Bé. It should be noted, however, that this applies only to the production of 22 per cent commercial lactic acid, and the 44 per cent edible grade. The 50 per cent water-white edible grade is made from U.S.P. calcium lactate. For the less highly refined grades, then, the concentrated solution from the evaporator is run to a breaking tank where 66 deg. Bé. sulphuric acid is added to convert the calcium lactate to lactic acid and a precipitate of calcium sulphate.

The sulphate is filtered off in a Shriver filter press equipped with rubber plates and frames, and the filtrate run to a tank where it is agitated with activated carbon which is finally removed from the product by filtration in chemical stoneware vacuum filters. The product is weighed into tight oak barrels ready for shipment.

A Trick of the Trade

For the production of more concentrated lactic acid, a slightly different technique is required. In making the edible 44 per cent grade, technical calcium lactate is dissolved in water and sulphuric acid is added just as in the case of the 22 per cent acid. The calcium sulphate sludge is removed by filtration and then additional calcium lactate is added to the filtered acid, dissolving in its water. With the use of sufficient sulphuric acid for conversion, this lactate, too, is transformed into lactic acid and by this building-up process, a 44 or 50 per cent acid can be formed. This acid is finally purified by decolorizing with activated carbon and filtering as described in the preceding paragraph. The 50 per cent water-white edible grade is made in exactly the same manner, except that the U.S.P. grade of calcium lactate is used, rather than the technical grade.

Still one other product, sodium lactate, is also made in the new plant. This is produced in both the technical and water-white grades, by reaction of the corresponding type of lactic acid with sodium hydroxide. This material is concentrated to any desired degree and is shipped and sold as a solution.

This, then, describes the new plant as it is today operated. For the future, there is the possibility of employing cheese whey in the process and there are simplifications and improvements contemplated in the purification stages. It is anticipated that an extraction process may be adapted to this purpose. Meanwhile, the responsible executors of this development, Mr. Chappell and his associates, Messrs. Gori and Stringer (to all of whom we are much indebted for assistance with the manuscript) are going ahead, firm in the belief that surplus milk utilization is still in its infancy. To what distances from the dinner table this and other farm surpluses eventually will go, no one today would be wise to predict.

Static Hazards Met in Solvent Handling

By JOHN T. MORRIS
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Franco-American Chemical Works
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ASSUMING safety in operation to be an essential factor in manufacturing, chemical industry and particularly the solvent business must heed this development. In 1729 Stephen Gray discovered that the energy known as static electricity was transferable from one body to another by contact. Now, 200 years later, industry finds itself acutely cognizant of static's existence, high speed transmission equipment having nurtured it well, until today it represents a hazard of considerable magnitude throughout industry's many phases. When these electrical charges run rampant in grain elevator dust, in the sugar refinery, or where solvents or flammable petroleum products are being handled, the complications are quite involved. One of the factors having a definite bearing in increasing or mitigating electrical intensities, and thereby the danger, is the varying degree of conductivity of the transmitting medium or material.

Electricity, though few think of it as such, is an ever present component of nature and manifests itself in diverse ways. That known as static is, from all basic appearances, caused by friction, and everyday materials, because of compression within their molecular structure, generate their share. Let us introduce as an example one of the subtle manifestations of this force. When carbon dioxide is released from compression, an acute shock may be experienced when the metal parts in contact with a good ground are touched. The charge in this instance is carried by solid particles produced at high velocities by expansion of the gas in the cone aperture, resulting in friction. Several nationally known manufacturers of fire fighting apparatus using this gas as a combustion deterrent evidently are aware of this condition, having equipped the nozzles of the dispersion cones with rubber grips. This observation bears out statements chronicled in the last 20 years that dry, cold atmospheric conditions are optimum for generation of static force.

The solvents industry would profit much by adopting some of the precautionary measures utilized by the petroleum refiners since the danger through flammable vapor conditions is practically identical in either field. There is no denying that should an electrical discharge be propagated on a solvent-laden atmosphere, with proper air ratio a violent explosion will result. Most plant men have an acquaintance with static electricity in connection with maintenance on both driving and conveying belts. Copper applicators have helped to remove these built-up potentials for years, or at least have curtailed visible discharges through air gaps. The use of steam to increase humidity has been advocated as a neutralizer to static occurrence. Nevertheless, it must be borne in mind that compressed steam or air generate considerable voltage when valved into a chilled atmosphere. Thus, the argument presents itself against the use of air under pressure as a motivating agent in the transfer of solvents.

Lacquer or paint sprays, whether the particles are minute liquid globules, or solids, are susceptible to the carrying of charges. We might remark that much lower voltages will ignite a vaporous than a solid mass. This brings to mind the danger encountered in blower and duct systems connected up collectively throughout structures in which flammable coatings are applied. Volatile liquid chemicals pumped in a manufacturing chemical plant should have the discharging orifice enter the tank or container below the liquid level for, despite the fact that high voltages may be generated by friction of flow in a pipe line, the real danger exists at the point of emission where the line ends and an air-vapor gap prevails. In general, it is found that liquids of poor conductivity charge readily, yet a solvent that has proved a good conductor may flow through a pipe line for considerable distance with no apparent generation of charge until it reaches the point of egress where the electromotive force is built up.

Very small quantities of free acid present in various organic liquids (esters) definitely lower the amount of static charge they will develop. Pure chemicals like acetone are far more susceptible to the development of high electric potentials and, therefore, should be handled carefully. Yet a large vertical tank containing water into which was being pumped isopropyl acetate through an 18-in. manhole gave off a heavy spark which caused the entire top of the vessel to be blown off. Luckily, the high dilution of the solvent in water prevented the contents from catching fire. The 4-in. fill pipe, suspended as it was, ungrounded, in the manhole opening, made it possible for the current generated to jump through the flammable vapor. Metal clamps connected to suitable grounds would have prevented this explosion. When liquids of low flashpoint are dropped onto scales and weighed in quantity, it is advisable that copper platform plates be installed, replacing the customary wooden center square. The plate is to be connected with a free-floating ground connection allowing the weighing to be done accurately.

Perhaps it will seem far-fetched to suggest that chemical manufacturers having railway sidings in use for filling and emptying tank cars of volatile materials should ground the metal rails to the earth every 50 ft., yet this has been common safety practice in gasoline refineries for years. The structural steel framework supporting equipment subject to unseen stray currents, should be integrally grounded, metal to metal, from the base of every individual column deep into Mother Earth as an added safeguard.

While on the subject of grounds an incident comes to mind where the workman in the presence of his foreman carefully attached a ground clamp to the wooden frame of a truck upon which a tank of solvent was being filled. Volition was shown, but needless to say, not intelligent application. When preparing earth connections, certain fundamentals must be recognized. Voltages ranging from a paltry few to thousands can be encountered in pipe lines, usually proportional to the rate of flow, while those on belts and machinery are in ratio to operating speed. Ground wires should be of heavy stranded copper directed through shortest distances to a copper mass imbedded at least 4 ft. in the earth, or else to running water lines. The ohms resistance in these wires should be checked from time to time to see if they are capable of carrying the currents produced safely. Also, remember electric field intensities will be greater at sharp corners on equipment

than on rounded surfaces or flat plates. One strict law of safety that should predominate is always to contact fill pipes with grounded containers. Go even further. When cleaning or aerating tanks, stills or other such equipment, the line should be bonded to the equipment at hand throughout the duration of each cleaning operation.

Distillation, vapor scrubbing, clarification and absorption systems designed in metals are not immune, though interconnected by piping to the earth itself, since numerous non-conductive gaskets are used in the assembly of flanged connections. Usually aluminum and copper fractionating column sections are prepared by bolting together rigid iron rings over which the metal sections are flanged, an asbestos gasket being sandwiched between to guarantee a tight joint. It is logical to expect that electrostatic charges will be carried off by the steel bolts in contact with the iron rings, and thus ground the column in its entirety, but repeated expansion and contraction of the unit as a whole during operation, plus the attendant evil of corrosion, disrupt these contacts and may isolate portions of the column. To overcome this, brazed copper straps from section to section down to the base will assure positive transmission.

All the aforementioned methods of bonding with wire, bars, and so on, are efficient if maintained by frequent inspection, but there is a tendency among workmen to leave off these connections when making repairs and additions. Chains should never be used when a solid or stranded cable can be employed.

The transfer of dry chemicals is also hazardous. Sulphur, for instance, in handling will develop amazing quantities of static. When charging or discharging materials that dust readily, one should be prepared to encounter the danger of dust explosion. A wheatstone bridge will gage the resistivity of materials of low resistance, and static voltmeters will measure higher ones. For general identification of electrostatic occurrence around the factory, we recommend a handy electrical device known as the Test-O-Lite, which may be pocketed in the same manner as a pen.

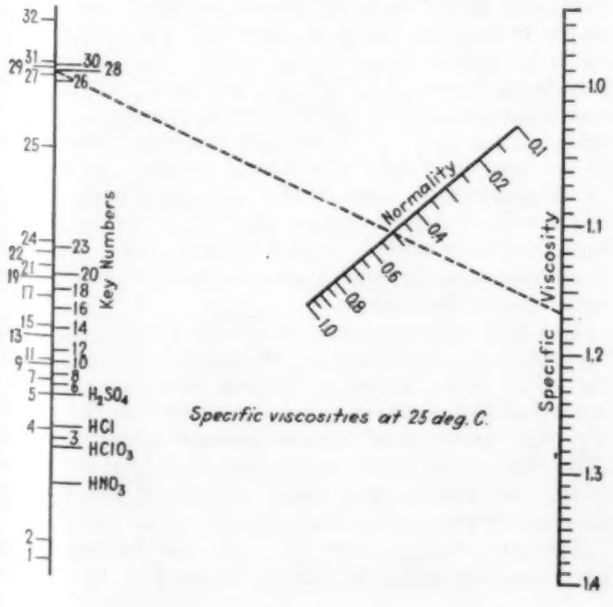
Viscosity Nomograph For Salt Solutions

By D. S. DAVIS

Dale S. Davis' Associates
Watertown, Mass.

IN DESIGNING chemical engineering equipment where the flow of salt solutions has to be considered, it is frequently necessary to estimate viscosities at various concentrations. The accompanying alignment chart facilitates such estimation in the case of aqueous solutions of 40 industrially important salts and four common acids and is based on data given in Perry's "Chemical Engineers' Handbook", p. 679 (McGraw-Hill, 1934).

Chart for determining viscosities of salt solutions



This originated with Reyher (*Z. physik. Chem.*, **2**, 1888, p. 749) and with Wagner (*Z. physik. Chem.*, **5**, 1890, p. 31). As tabulated in the literature the data cover concentrations of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, and 1 normal, while the chart embraces all normalities between 0.1 and 1. At the same time it retains a conveniently compact form.

The mechanism of the chart is predicated upon Arrhenius' relationship (*Z. physik. Chem.*, **1**, 1887, p. 285):

$$\mu = \mu_1^n$$

where μ is the specific viscosity (referred to water at the same temperature) of a solution of normality, n, and where μ_1 is the specific viscosity of a normal solution.

For ready reference and to avoid overcrowding of the chart one of the parallel axes bears a scale of key numbers each corresponding to one or more salts. The key numbers may be identified by means of the accompanying table.

Key Numbers Identifying Points on Specific Viscosity Chart

	Chloride	Nitrate	Sulphate	Chromate
Aluminum			32	
Barium	12	5		
Calcium	16	11		
Cadmium	13	17	26	
Cobalt	23	17	27	
Copper	23	19	28	
Lead		7		
Lithium	15		25	
Magnesium	22	18	31	
Manganese	24	20	30	
Nickel	23	19	29	
Potassium	2	1	8	9
Sodium*	6	4		
Silver		3		
Strontium	14	10		
Zinc	21	17	31	

*Sodium bromide and chlorate respectively 4 and 5.

In using the chart, find the key number from the table and connect the point so numbered on the axis at the left with the normality of the solution, producing the line to meet the specific viscosity scale in the desired value. Thus, to find the specific viscosity of a 0.5 normal aqueous solution of copper sulphate at 25 deg. C., connect 28 (key number) on the key number scale with 0.5 on the normality scale and produce the line to meet the specific viscosity scale in the value 1.165.

CARBOYS

Can Carry Chemicals Safely and

By R. W. LAHEY

American Cyanamid Co., New York, N. Y.

CARBOYS, in one form or another, have been used to transport acid since the first production of these corrosive liquids. But despite their long and commendable record of service, they are treated by some users as the proverbial "step child" of chemical industry. Although it is acknowledged to be bad practice, they are often stored in the open, usually in the least desirable part of the yard. They are exposed to extreme heat and cold, rain, snow and ice, and often rest in mud. Compare this unfair treatment with the care taken of other returnable containers such as drums and cylinders!

Many shippers object to using carboys because they believe that their tare weight is excessive, that they must be handled with extreme care, are hard to stack and tier, require excessive storage space, and must be frequently inspected and repaired.

Notwithstanding these many bad features, their value has been proved over the many years of their use, for no other containers have been able completely to replace them. How would shippers of heavy chemicals fare without carboys to carry corrosive liquids to their customers? The ingenuity of the American business man would probably have found a solution, but it is very doubtful if any substitute containers would be as satisfactory or would carry the liquids as cheaply and as well as the present-day carboys. Recently all rubber drums up to 13 gallons capacity and rubber lined steel drums have been developed to hold muriatic acid; chrome nickel and aluminum drums handle certain strengths of nitric acid, but the first cost is so high that these drums have as yet been used only in a special service. In the case of sulphuric acid, steel drums are much cheaper than the special drums used for nitric and muriatic acids. Most sulphuric acid is carried in steel drums but there is no indication that the drums are increasing their share over that of the carboys.

The first carboys were extremely fragile and crude compared with those today. Warren N. Watson, secretary of the Manufacturing Chemists Association, recently unearthed the communication reproduced on the following page, which is of historic interest in describing the difficulties which were experienced with carboys almost a hundred years ago. Many important developments have taken place since that time.

The first bottles were the so-called balloon bottles which are still made in Europe. (See Fig. 1). A few

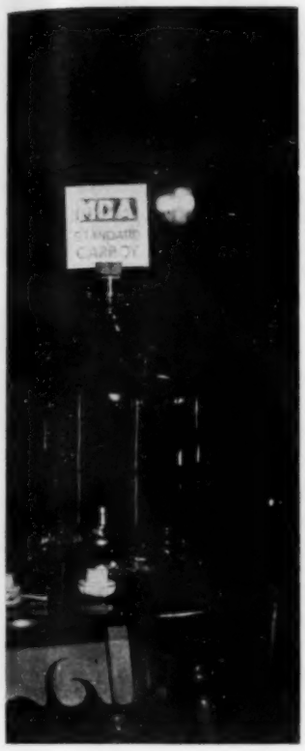
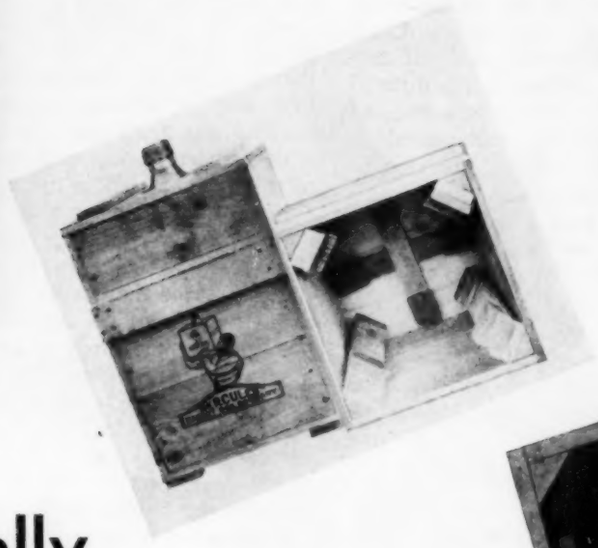


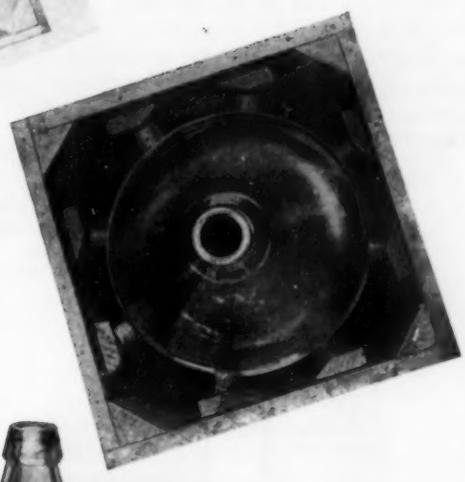
Fig. 1. Steps in the development of the modern MCA standard carboy and the two men who have been most responsible: at left, Maurice F. Crass of Grasselli and at right, Thomas P. Callahan of Merrimac.

tainers. It is a most interesting organization for there are three generations of Gayners now actively engaged in the company. A visit to their plant impresses one with the sincerity of their service. They have a great responsibility to the chemical industry which they fully realize.

The first improvement in the manufacture of carboy bottles was to make the so-called straight-side type. Whereas the balloon bottle was blown resting on a clay bottom mold only, the straight-side bottle was blown in a complete mold. Straight-side bottles are made in three shapes i.e. the 12-gallon, the $12\frac{3}{4}$-gallon or the so-called "squat" type, and the $12\frac{7}{8}$ gallon which is the

Figs. 2, 3 and 4. At left, the Hercules type of carboy packing in which side cushions are glued to spring boards resting on corner posts. Below, the Smith packed carboy box supports the bottle with numerous cylindrical shaped blocks of virgin cork.

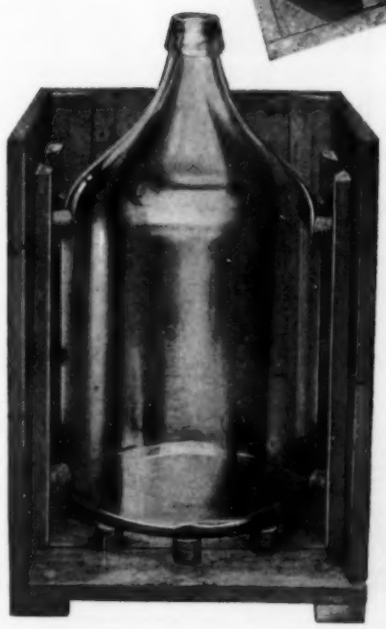




Economically

of them find their way into this country carrying imported liquids, such as formic acid. They are very fragile, the glass is poorly distributed and there are large variations in their capacities and shapes. But many of these bottles are sold to antique shops for resale as old European water bottles and quite recently florists have planted in them special varieties of plants which make them an attractive novelty.

Originally, the bottles were made in this country by the Illinois Glass Co., the Brookfield Glass Co., Whitney Glass Works, Whitall Tatum Co. and the Gayner Glass Works, but for the last several years all large carboy bottles have been made by Gayner. This company more than any other is responsible for the remarkable improvements which have been made in these con-



Webster, Mass. July 9, 1845.

Messrs. Carroll & Crosby:
Gentlemen;

Please send us by Rail Road two Carboys, Oil of Vitriol. Please see that the Carboys are well packed. We have lost two Carboys in consequence of being badly packed.

Yours
Webster Woolen Mill
by (signed) L. Robinson

same as the first type with height added to give the additional capacity.

Manufacture of the large carboy bottles is no simple production problem. The bottles are so large and the quantities in demand so small that they cannot be formed on automatic machinery. Glass is hand gathered and blown into a steel mold. Blowers must be highly skilled and there are comparatively few of them in existence. Slow cooling or annealing is essential to prevent stresses and strains in the glass, so they are placed in lehrs or ovens immediately after blowing and the temperature is gradually lowered over a period of 24 to 36 hours. All bottles are thoroughly inspected and tested for defects before they leave the manufacturer's plant.

After some years of use, shippers demanded even greater strength from these bottles and the Manufacturing Chemists' Association through its Carboy Committee, financed and conducted an investigation of carboy bottles. The help of the Massachusetts Institute of Technology and the Gayner Glass Works was enlisted for this work. Thomas P. Callahan was placed in charge of this work and with the help of Maurice F. Crass, committee chairman, and others conducted this investigation. Strong and weak points were found in each of the three types of straight side bottles and finally a new shape was developed which embodies all of the best features of the existing types. This bottle is now in extensive use in the industry and is known as the 13-gallon M. C. A. Standard Carboy. It is considered by those skilled in the art to be the best bottle so far produced. The successful result of this exhaustive investigation represents a real contribution to the industry.

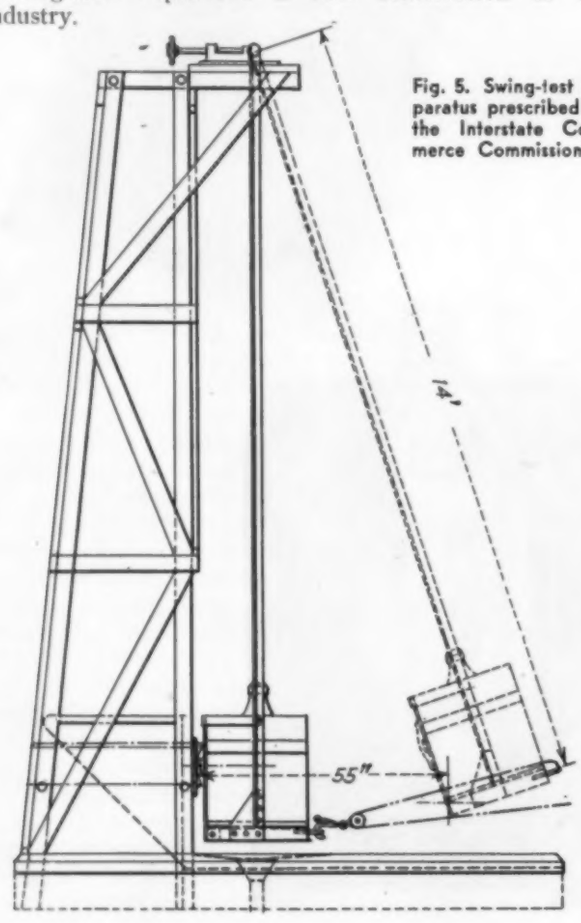


Fig. 5. Swing-test apparatus prescribed by the Interstate Commerce Commission.

The problem of protecting the glass bottle from abuses in handling and transportation is as important as the matter of the strength of the bottle itself. In fact, it is one of the most difficult problems which the industry has to solve. Experience has proved that the bottle must be protected by a wooden case allowing only the neck to project. The bottle has to be so fastened and cushioned into the box in order that the blows and knocks which the box receives are not transmitted directly to the bottle.

The first cushioning materials which were used for many years were hay or straw, ground cork, mineral wool and similar products. These were packed all around the bottle to keep it from hitting the sides of the box. There were many bad features to this method; for example, the hay is combustible and when wet its cushioning properties are destroyed and the tare weight greatly increased. This cushioning was not durable, thereby requiring constant repacking of the bottles. The first step in overcoming the bad features of the hay packing was to suspend the bottle at the sides and bottom with wooden spring and rocker strips. Some packings of this type are still in use. Then came the use of virgin cork blocks pressed against the sides and bottom of the bottle. Usually side pressure was applied by driving shims behind the corks or the corks were driven horizontally from the corner of the box toward the center as in the case of the modern Smith packing. This step proved a great improvement over the wooden strip method of suspending the bottle.

A further development was the use of ground cork molded into blocks, using asphalt as a binder. Eight of these blocks support the bottle in the box. The most recent development is the use of special rubber blocks to suspend the bottles at the shoulders.

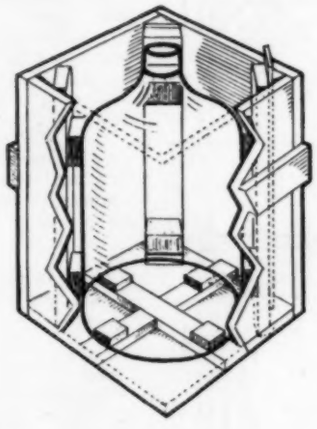
Carboy breakage has always been a troublesome matter to the railroads and the Bureau of Explosives has had much trouble from breakage in transportation. Occasionally these accidents caused injury to workmen and sometimes fires developed, usually resulting from damage to nitric acid containers. As a result of this, in 1920, the Bureau of Explosives and the Manufacturing Chemists Association formed a special joint committee with Colonel G. E. Carleton of the Bureau of Explosives as chairman to study this question. Included in this committee was Maurice F. Crass of the Grasselli Chemical Co. (now of duPont's) who for many years has served as chairman of the Carboy Committee of the Manufacturing Chemists Association, C. P. Beistle, chief chemist of the Bureau of Explosives, and T. P. Callahan of the Merrimac Chemical Co. (now of Monsanto's). These men have given a great deal of time and study to carboy problems and most of them are still actively endeavoring to improve conditions through the Carboy Committee of the M. C. A.

It was through the investigation of this Committee that transportation abuses were duplicated by a test which provides the shipper with a gage of the worth of his carboy. This was accomplished through the actual recording of the shocks transmitted to cars containing shipments of carboys. The standard adopted was that shock which a carboy must withstand when a car travelling at six miles per hour hits a bumper and is suddenly brought to rest. From this, the Committee devised the present swing test apparatus, a diagram of which is shown in Fig. 5. The bottle is filled with

water and the boxed carboy is bumped against a concrete block. To comply with the Regulations for shipping dangerous liquids, 90 per cent of the carboys must withstand swing tests of 55 inches when striking both on the side and on the bottom. When this apparatus was first devised it was difficult to find containers which would survive this test. The hay packed and wood strip suspensions then in use, barely passed. The virgin cork block packing will test from 60 inches up to 75 inches and some might survive even greater swings. A few spectacular tests of the more recently designed packings have been made up to three or four swings from 105 inches.

To interpret results of a swing test into an economical and safe package is rather difficult. It is safe to assume that a carboy which will pass the more severe tests will be able to stand greater transportation abuses, but this is only part of the story. A carboy must be able to withstand such tests after months of service and under all conditions of temperature. In all considerations of carboy types, the matter of safety is paramount. After this has been satisfactorily decided, then cost should be considered. We must not be misled by the original cost as this is not always a major consideration. As these containers are returnable and must be repaired from time to time, the per trip cost is the only real measuring stick. Detailed accounting records of carboy service are not ordinarily maintained. This requires special accounting, but the possible savings are well worth the effort even to a small user. Constant repair and replacement of worn parts during the life of the box and the packing often totals more than the original cost of these members yet is usually so buried in the cost that it is often neglected.

Figs. 10, 11 and 12. The Aero carboy packing and assembled carboy box. Four bottom cork blacks are mounted on cross strips and eight rubber blocks of special construction serve as side cushions. Details of mounting of rubber cushions shown above.



Figs. 6 and 7. Above and at right, the Newark Steel Drum Co. carboy packing consists of four bottom corks mounted on cross strips and eight side corks, two at each corner post.

It is difficult to estimate the average life of carboys because of the many types, the widely differing services which they are called upon to render, and the treatment which they receive from shippers and consignees. The best information that can be obtained indicates the probable life of the various parts which go to make up the complete container approximately as follows:

	Average Life	Estimated Percentage of Total Cost of Materials in New Carboy [1]
BOTTLE ...	10 years	55
BOX	4 years	25
PACKING ..	1 to 3 years	20
		100

[1] These do not include the cost of labor for setting up box shooks, packing the bottle and fastening the cover on the carboy box.

This tabulation shows clearly that over 50 per cent of the total cost is represented in the bottle with an average life of ten years. It is therefore logical that

any extra protection which can be given to the bottle and which thereby increases its life is economically sound. This must be considered along with the repair or upkeep cost. Every time that a top is removed and the bottle taken out of the box the cost mounts. Assume that the labor cost on each box varies from ten to forty cents and the repair parts range from fifteen cents to more than one dollar. Using a low average recoopering cost of forty cents per repair and assuming repairs every six months, the cost is $2.80 during the four year life of the carboy box. This amounts to over 60 per cent of the original cost of the carboy. If the carboys average one repair annually on the same basis, the cost is $1.20 or over 26 per cent of the first cost. It therefore usually follows that the most economical carboy is the one requiring minimum repairs and a difference in the first cost can be quickly saved in reduced maintenance.

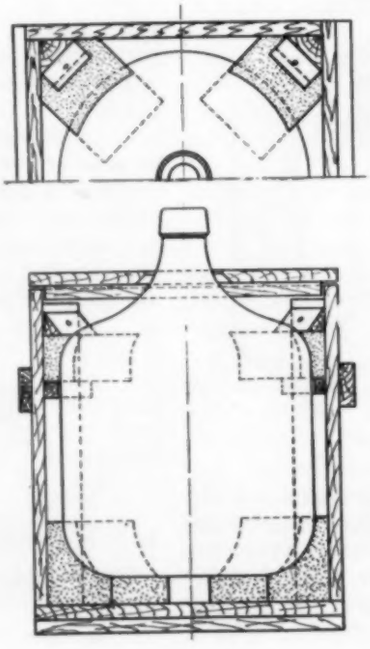
The more important types of carboy packing which are available today to the shipper are now to be described. There are certain other types in use, to be sure, but they are either not for sale or the quantity in use is extremely small. All these packings are in general use and of course have many times passed the prescribed Interstate Commerce Commission swing test of 55 inches.

The Smith packing (see Figs. 3 and 4) supports the bottle at numerous points with cylindrical shaped blocks of virgin cork measuring about 1½ inches in diameter. The bottom corks are attached directly to the bottom of the box by countersinking and fastening with adhesive. The side corks are mounted on strips (8 strips—2 corks to a strip). After insertion of the bottle, the side strips are dropped into the box at the corners and they are forced toward the center of the side by the use of two wedges. The strips are secured in place by nailing through the outside of the box.

The Hercules carboy packing can best be visualized by the attending illustration (see Fig. 2). The side cushions are glued to spring boards which rest on the corner posts only at the top and bottom blocks. This increases the regular cushioning obtained from the cork blocks. The bottom cushions consist of four virgin-cork blocks mounted on wooden cross strips. To assemble this carboy, the bottom cushions are inserted and the four cushion frames placed against the corner posts. The bottle is then forced down into its proper position.

The Newark Steel Drum Co. carboy packing consists of four bottom corks mounted on cross strips and eight side corks, two at each corner post (see Figs. 6 and 7). The bottles are packed by first inserting the bottom cushions. Then cushion blocks for two adjacent corners are nailed to the corner posts. The bottle is inserted and the remaining two side cushion strips are placed in the corners. Shims of varying thickness are driven down behind these side cushion strips thereby exerting proper pressure to hold the bottle in position.

Figs. 8 and 9. Front and section of top view of carboy packed with Armstrong's cork cushions.



The Armstrong Cork and Insulation Co. carboy packing consists of eight molded blocks which are made of ground cork using a binder of asphalt. They are so molded that they fit snugly into the corners of the box. Figs. 8 and 9 show that four of these molded cushions are placed in the four bottom corners of the box. After inserting the bottle, pressure is applied at the neck and the four upper cushions are put in position. Retaining strips are then nailed to the corner posts to prevent vertical movement.

The Aero carboy packing is the newest type. The bottom cushions consist of four virgin cork blocks mounted on wooden cross pieces. There are eight rubber blocks of special construction used as side cushions. Each of these rubber blocks is mounted on a bevelled hard wood block so when pressure is applied, it is exerted on the bottle shoulders diagonally and not horizontally. Two blocks are fastened together with wooden spacer strips to make a complete corner assembly. The backs of the cushion blocks and the faces of the triangular corner posts are grooved to allow the insertion of a shim at each corner. The function of these shims is to apply pressure and automatically to lock the cushions in their proper positions. The carboy is assembled by first inserting the bottom cushions. After two adjacent corner cushions are placed against the corner posts, the bottle is inserted. The other two corner cushions are then placed in the box and the four locking shims are driven down.

By way of summary, the carboy user, in choosing his container should consider the relative merits of all types of carboys from the standpoint of safety and cost per trip. The following six considerations should receive careful attention:

(1). The packing should be installed with the minimum chance for human error in suspending the bottle in the box in order to reduce breakage and recoopering. The assembly operation of placing the bottle into the box is usually handled by unskilled men and that type of packing which eliminates or minimizes human error will save a lot of trouble.

(2) The packing should be so designed that pressure on the bottle is exerted equally. Excessive pressure and pressure unequally distributed is liable to cause a collapse of the bottle when the container is subjected to stresses and strains.

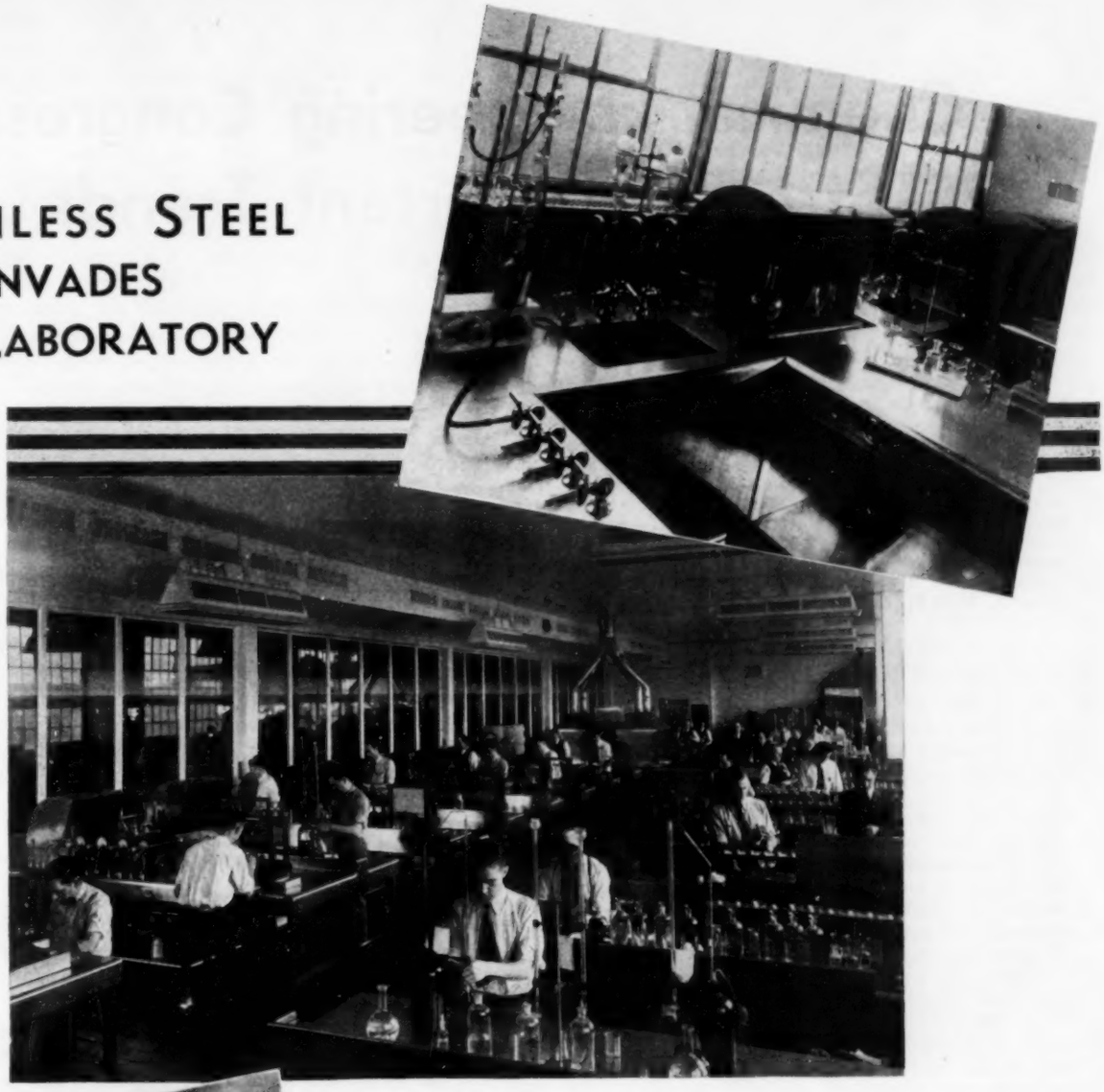
(3) The cushioning qualities of the packing should be tested under the most severe temperature and humidity conditions which the container may encounter.

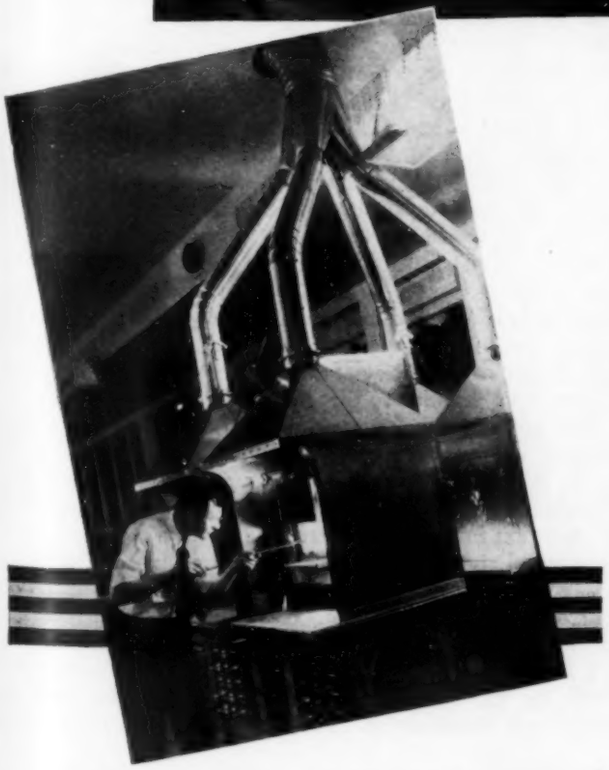
(4) The ability of the cushions to absorb shocks and withstand continual abuse should be determined.

(5) The ability of the cushioning members and the supports to withstand acid must be taken into account.

(6) The amount of repairs and frequency of recoopering should be considered. The effect of changing climatic conditions from extreme cold to extreme heat and from high to low humidity sometimes causes distortion and warping of the interior packing which is under pressure.

STAINLESS STEEL INVADES LABORATORY





STAINLESS steel has gained new ground in the growing competition among corrosion resistant materials of construction. In its exclusive use as the structural material for all furnishings and equipment in the new analytical laboratory of the Ford Motor Co.'s huge River Rouge plant, the alloy has entered one of the few remaining industrial equipment fields which had yet to feel its influence. The 18-8 variety has been used in all work tables, hoods, furnace jackets and flues, and much of the smaller equipment and fixtures in the new laboratory.

Each complete table top is made of $\frac{1}{16}$-in. stainless steel sheet, prefabricated in a one-piece, all-welded construction with rounded edges and fillets. The tables are equipped with built-in sink; down-draft hood; utility shelf; 110-volt and 220-volt electrical outlets; tubing connection outlets for gas, air, water, and vacuum; and tap outlets for hot, cold, distilled and ice water—all of stainless steel. Used for the jackets on the four electric heat-treating furnaces, the metal has shown hardly any discoloration after five months' service. Not stopping with equipment, the stainless steel theme has been carried further by use of the sheet form of the metal for a continuous wall covering from the red tile floor up to the windows.

Chemical Engineering Congress Stresses Important Trends

EDITORIAL STAFF REPORT

Editor's Note: Of the 125 papers presented before the recent Chemical Engineering Congress of the World Power Conference, those dealing with materials of construction, unit operations and the more technical trends of development were reviewed in *Chem. & Met.* last month. (August, 1936, pp. 413-23). Of the remaining papers, four somewhat more general groups are abstracted below. For complete copies of these papers the reader is referred to the Papers Bureau, Office of the International Secretary, 36, Kingsway, London, W.C. 2, England.

IN PRESENTING his report for the section on Education and Training of Chemical Engineers, which was Section J of the recent Chemical Engineering Congress in London of the World Power Conference, Prof. H. E. Watson of the University College said, in part:

> Chemical engineering in the United States is undoubtedly far better organized and further developed than in any other country. There are over 10,000 students taking chemical engineering courses, comprising 17 per cent of the whole number of engineering students. It is interesting to note that 25 years ago training in chemical engineering was very similar to that which is now given in other countries. The course was composed of a selection from existing chemical and engineering courses and the teachers had been mainly trained as chemists. The great development which has since taken place appears largely due to the recognition of chemical engineering as a separate subject. . . .

But he hastened to point out that the American system which had been competently outlined in a paper (J-5) by Prof. Alfred H. White of the University of Michigan, was not necessarily the best for other countries. He quoted from the paper (J-2) of Professor A. Eucken of Göttingen to show that valuable results have been obtained in other ways in Germany, although he pointed out that some of the best German chemical engineers have been the product of the course in technical physics at Munich. Apparently that course approximates quite closely chemical engineering curricula in the United States.

"In England," according to Professor Watson, "in spite of the existance of an Institution of Chemical Engineers, which has advocated for the last decade instruction in chemical engineering along lines similar to those adopted in America, students have been largely trained as chemists and an attempt has been made to apply a finish of chemical engineering." He strongly endorsed the views of Cremer and Underwood (J-3) whose paper is published at greater length in this issue.

The rapid growth of technical education in Japan since 1912 was emphasized in a paper (J-4) by Prof. Saburo Uno. Applied chemistry and engineering courses predominate but several institutions have well balanced chemical engineering instruction in which effort is made to develop originality and personal and professional ethics.

The education scheme of the Institution of Gas Engineers in England was cited as an example of a course of training managed and financed by an industry and offering all of its employees an opportunity of acquiring more than rule-of-thumb knowledge in their field. More than 400 are annually enrolled in these studies of fundamental science as well as gas and fuel technology according to C. H. Creasey (J-3B). Prof. A. W. Nash (J-3C) showed how elaborate an educational foundation is required for the well-trained oil technologist of today. Physics, geology, palaeontology, geophysical chemistry and mathematics precede and underly courses in civil, mechanical and electrical engineering.

Management and Administration

Dr. W. H. Garrett, manager at Ruabon, North Wales, for Monsanto Chemicals, Ltd., had the difficult task as general reporter for Section K of coordinating seven papers dealing with statistics, administration, safety and welfare. His comprehensive outline and report of 13 pages might be read with profit by every plant manager in the process industries. He considers first, the prevention of occupational risks and accidents in chemical industry, drawing some interesting comparisons between the important paper (in German) of Dr. H. Martius (K-1) and the excellent summary of British practice by C. S. Robinson and H. R. Payne of the Imperial Chemical Industries, Ltd. (K-4). In accident treatment, British practice stops short at first aid, whereas in German industry the company is responsible until the final cure of the injured worker. The same philosophy applies generally to industrial diseases. In Germany the industrial and trade associations handle their own compensation risks and provide and enforce safety regulations. Martius shows that in Germany only 10 per cent of the accidents and 23 per cent of the fatalities in chemical industry are due to risks peculiar to this industry.

The application of statistical methods as an aid to industrial efficiency was clearly shown in a paper (K-2) by E. S. Pearson of the Royal Statistical Society. He illustrated the statistical approach to practical problems of variation involved in control of quality in glass manufacture. Prof. W. P. Fiske of Massachusetts Institute of Technology applied cost analysis to process expense control in a valuable paper (K-5) that supplemented his previous paper (*Trans. Am. Inst. Chem. Eng.*, Vol. 30, p. 1 ff; also *Chem. & Met.*, Vol. 41, pp. 26 ff. and 69 ff., 1934) on the application of costs to equipment section, design and obsolescence. Five main avenues of approach

are given: (1) profits; (2) unit costs; (3) historical cost comparisons; (4) standard costs; and (5) budgets.

The planning and control of chemical manufacture by T. Donaldson of Great Britain (K-3), the influence of location upon production costs by J. L. Warner of the United States (K-6) and considerations influencing the formulation of chemical engineering projects by Crosby Field of United States (K-7) offer much of value to the manager and administrator. Dr. Garrett, in his summary, considered the following factors: plant location, market, transportation, raw materials, distribution of finished goods, labor requirements and supply, plants and buildings, effluents and byproducts, growth, research and legislation. He noted the following trends:

(a) The trend toward greater legislative control of industry, through many different approaches, e.g., Factory Acts, tariffs, currency regulation, taxation, import and export limitations or prohibitions, freight regulations, etc.

(b) The increasing mechanization of industry is tending both to reduce the total number of workers, and to replace skilled tradesmen by unskilled labor.

(c) The influence of factors other than quality of product and cost of manufacture in deciding the advisability of chemical engineering projects is increasing in importance.

(d) A definite trend toward increased statistical control of industrial operations, due to increased competition and the shrinkage of profit margins.

(e) Geographical considerations are tending to decentralize industry in countries of large area.

(f) Owing to the complexity and inconsistency of railroad freight rates, there is an increasing tendency to use road transport.

(g) There is a world-wide concentration on industrial safety work, owing to both the humanitarian and the economic aspect of this work.

(h) There are indications that standardization of machinery guards and of protective garments and appliances will become necessary.

In the general report for Section L on "Trends of Development," Prof. H. W. Cremer, King's College, London, had three groups of papers to consider, i.e., I. Water Treatment, including heat flow in steam plants; II. Heavy Chemical Industries, notably sulphuric acid, phosphate and calcium carbide; and III. Biological Processes —fermentation and fumigation.

With the exception of Prof. C. Jacobsen's paper, (L-2), which was a presentation of modern theories concerning the influence of salts of brewing water on the chemical processes of brewing and the quality of the finished beer, the other papers from Great Britain (L-4 and L-6), Austria (L-8) and Germany (L-13), dealt with the softening and conditioning of water for steam raising. Professor Cremer pointed out that the tendency toward higher pressures and steam rates in modern boiler practice has necessitated considerable modification of standard practice for lower pressure. A notable feature of several of these papers is the emphasis laid on the need for a clearer understanding of the fundamental principles underlying the chemical processes of water softening and boiler feed-water treatment.

The general development of the sulphuric-acid industry in Japan was outlined by Motoro Matsui (L-9) who cited capacities of factories using the different systems in Japan, with estimated production costs in relation to the various methods of operation. Professor V. N. Shulz (L-10) dealt more specifically with the intensification of the tower process for producing sulphuric acid in the U.S.S.R. (See *Chem. & Met.*, Vol. 41, pp. 642-3, 1934), and in addition to describing new industrial forms of the pressure process, he gave an interesting account of research work on the study of the kinetics of the individual stages of processes using nitrous gases. Both the Russian and Japanese investigations have clearly demonstrated the possibility of increasing the intensity of production to obtain an output of 45 kg. and more of 100 per cent acid per cu.m. of a tower system per 24 hours. Intensification is attained in the tower process mainly by regulating the composition of the furnace gases and by modification in the method of spraying the towers and in temperature conditions.

Britzke and Volkovich (L-11) discuss the availability and methods of utilizing the numerous Russian deposits of low-grade phosphates. Kalsuharu Hibi (L-7) describes a new process for the production of a porous granular calcium carbide directly from a hot stream of molten carbide by atomizing it with gas under high pressure. The product can be charged directly into a cyanamide furnace without further modification. Of the papers on biological processes, most interest centered in that of Prof. J. W. Munro (L-3), reviewing the general principles of fumigation including the use of auxiliary fumigants, vacuum fumigation, distribution and disbursement of fumigants, and other relevant matters.

Research and Industrial Development

Prof. W. M. Cumming of the Royal Technical College of Glasgow, general reporter for Section M, summarized eleven papers dealing with fundamental and applied research, including chemical engineering and industrial developments. Referring to the outstanding paper of Dr. Charles M. A. Stine, (M-10), vice-president of the duPont Company, he said: "This contribution gives a clear differentiation between fundamental and what is termed 'pioneering applied research,' the distinction being one of purpose rather than of nature or quality. The primary importance of fundamental research is stressed as providing (a) a basis for future processes, (b) a logical approach to more complex practical problems, and (c) an assurance of continued leadership in quality and economy of production. Secondary factors are the creation of consulting specialists accessible to the applied research worker, and the strengthening of relations with the universities. The fundamental research work of the universities, however, cannot, for reasons stated, take the place of that carried on in the research organizations, although the relation between the two is admittedly very intimate. Fundamental research is not to be undertaken unless it can be sustained indefinitely through conditions of industrial depression. It is only to be undertaken as a long-range effort, and with sympathetic support."

Dr. A. E. Dunstan, chief chemist of Anglo-Persian Oil Co., Ltd., in his interesting paper (M-8), deals with the personnel and organization of an industrial research program and likewise stresses the importance of fundamental research as distinct from specific or industrial. He discusses the mutual inter-dependence of routine analysis, semi-scale development and research, and shows how such an organization functions in industry.

A. C. S. at Pittsburgh Tackles Professional Problems

EDITORIAL STAFF REPORT

AN ENCOURAGING sign of the times is the interest which the American Chemical Society at its Pittsburgh meeting, Sept. 6-11, has shown in some of the problems confronting the chemical profession. A symposium on "What Chemical Industry Expects of its Chemists" resulted in helpful views from several outstanding chemical executives and educators. H. A. Gait, president of Columbia Alkali and vice-president of Pittsburgh Plate Glass, held that the problem was mainly up to the individual—that college training could only be expected to teach the fundamental scientific principles along with sufficient facts to give the student a sound working knowledge of the science. W. S. Landis, vice-president of American Cyanamid chose a different tack—addressing his remarks directly to the college. "The chemist," he said, "if he is to develop into an administrative officer, must not limit his field of view to the laboratory desk or the drafting table and it is important that the college help him to enlarge and develop his vision, resting his education on a sufficiently broad basis to see the problems of industry as a whole. . . . The colleges must institute some course of programmed study in personality development. The specialist, valuable as he is in certain positions, is usually too narrow in his viewpoint for the administrative office and the colleges must recognize that there is a place for the individual with a general and broad education in the chemical field." His specifications are those toward which the chemical engineering departments of a number of American universities have lately been working.

F. W. Willard, executive vice-president of Nassau Smelting and Refining Co., declared that "unless a new concept of education is developed in our colleges and higher institutions, they will forfeit the public confidence they now enjoy. Inertia, vested interests and extreme conservatism are obstructing a sorely needed development.

E. F. duPont, personnel manager of E. I. duPont de Nemours & Co., Inc., also believes that now is the time to strengthen relations between industry and college so that the young graduates may be in the best possible position to participate in the present trend of increased industrial activity. "I believe," said Mr. duPont, "that the college graduate should understand better the modern industrial society with which he is destined to become affiliated. He should be told more specifically what goes on in the research laboratory, in the factory and on the sales firing line. From contacts each year with hundreds of these young men it appears to me that they concentrate too much on winning a diploma and not enough on things that lie beyond the diploma. Their pursuit of theory would be more profitable and interesting if they gained early in their course, an appreciation of the ways in which theory is applied, thus shortening the orientation period when entering industry. It is still true that industrialists must think in terms of income and outgo, in terms of sales revenue and costs. The student can hardly learn too soon that the dollar sign is an unwritten but potent factor in every industrial chemical equation."

Outstanding among the papers presented before the joint symposium on Synthetic Resins and Plastics, was a contribution by Dr. H. R. Dittmar of the Ammonia Department of the duPont company which described a new water-clear plastic, strong as glass, flexible and non-shattering. This new product, which has been given the trade name "Pontalite," is a polymerized methyl methacrylate. A factory for its manufacture is under construction and commercial production is scheduled to begin early in 1937.

Although softer than glass, the new plastic is hard enough to be widely useful. It is thermoplastic and can be sawed, cut, drilled and polished, as well as molded readily to any desired form. A liquid intermediate variety can be poured into molds and hardened and in this way castings are readily made. Solutions of the plastic as well as the liquid intermediate form have been used successfully as impregnants for wood, cloth, paper, stone and electrical apparatus. Materials treated in this way are much more resistant to water, oils and chemicals. Because the methyl methacrylate is compatible with other resinous materials such as nitrocellulose, rosin, ester gum, certain types of Bakelite, several glyptals, chlorinated rubber, courmarone resins, etc., it is believed to have a very broad application in the specialty coating field. Relatively low specific gravity (1.19 to 1.20) together with its high mechanical strength, makes it of interest to the aircraft industry.

Charles Allen Thomas, and Frank J. Soday of the Thomas & Hochwalt Laboratories of Monsanto presented further information on the varnish resins obtained from cracked petroleum distillates (See *Chem. & Met.* March, 1934, p. 123). By varying the conditions of polymerization it has been possible to obtain hydrocarbon resins with very desirable characteristics. One is the high dispersing and wetting action of the resin solution on pigments. The authors report that a solution of the resin in a hydrocarbon solvent disperses pigments better than any known synthetic or natural resin. Such a resin solution also wets pigments most markedly. Another characteristic of these highly reactive resins is their ability to react or co-polymerize with semi-drying and drying oils. An example of this is the combination of the resin and castor oil.

Experiments on the utilization of sawdust as a plastic material were described in a paper from the Forest Products Laboratory of the United States Department

of Agriculture. S. M. Martin, Jr. and J. C. Patrick of the Thiokol Corp., Edwin R. Littman of Hercules Powder Co. and B. W. Nordlander of the General Electric Co. contributed valuable papers to this symposium.

New Metals and Alloys

Some of the fundamentals governing the development of new alloys for chemical industries were reviewed by B. D. Saklatwalla of U. S. Rustless Steel and Iron Corp. Although the science of metals is progressing rapidly, it is still necessary in many cases to resort almost entirely to empirical determination of the suitability of a new alloy. This is due principally to the fact that various combinations of alloying elements produce entirely novel effects, rather than a combination of the individual effects of each. The use of alloy steels is continuing to spread in the chemical field, but in spite of this, there is a strong leaning toward the newer line of composite metal materials, both those composed of two different metals bonded together and those made up of a metal and a non-metal.

In a discussion of corrosion-resistant and scaling-resistant steels, Florence Fenwick and John Johnston of the U. S. Steel Corp. pointed out that the corrosion resistance of a metal depends upon the extent to which the chemical product of corrosion resists further attack by the corroding substance. The corrosion product forms a film on the metallic surface which isolates it from the corrosive environment to a degree dependent upon the imperviousness and stability of the film. This view, which is supported by experimental evidence, was used as a basis for discussion of the range of usefulness of some of the corrosion-resistant alloy steels.

Chromium steels and their latest modifications were covered by W. J. Priestly of the Electro Metallurgical Co. Chiefly because of their wide range of adaptability, these steels have played an important role in the development of chemical equipment. Chromium is the basic alloying element used in every one of the wide selection of corrosion-resistant steels now available.

The fundamental properties of pure nickel served as the basis of an account of new and useful developments in nickel alloys, presented by Robert J. McKay of the International Nickel Co. The service characteristics of nickel-copper alloys, the most important members of the nickel group from the standpoint of chemical usage, are given, with particular attention being devoted to the variation in physical properties and the abilities and limits of corrosion resistance.

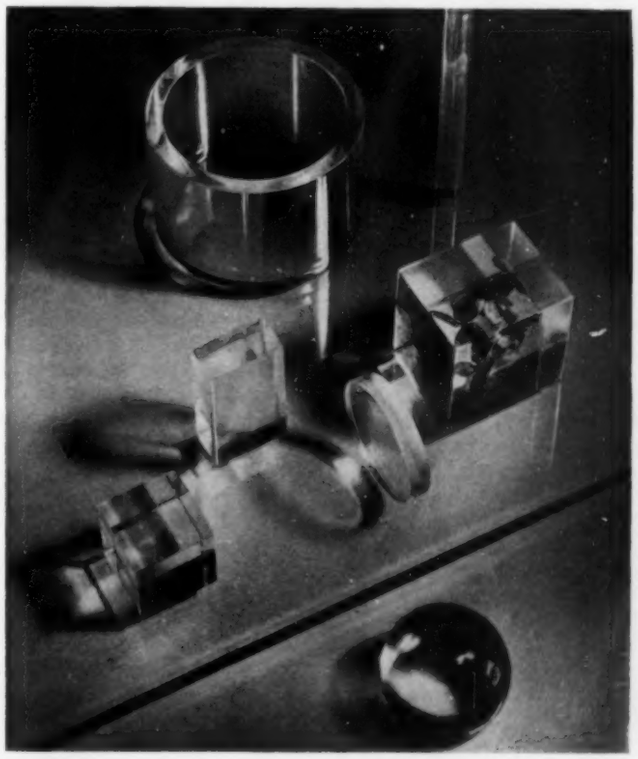
D. K. Crampton of the Chase Brass & Copper Co. reviewed advances in the field of copper base alloys. Copper tubes are being favored for use in water supplies, pulp lines in the paper industry, air lines, oil lines, vapor lines, etc. For most corrosive waters, red brass is the preferred material. The cupro nickels are gaining ground in the condenser tube field. For tanks, kettles, evaporators, bolts, springs, agitators, etc., the silicon bronzes are being increasingly applied. Among the newer alloys is aluminum brass for condenser use and particularly the recent modification containing both tin and aluminum. Another interesting new development is the use of antimony in many brasses to prevent dezincification.

Among the properties which dictate the use of aluminum for chemical equipment are, as presented in a paper by W. L. Fink of the Aluminum Co. of America, low density, high thermal and electrical conductivity, high ductility, and the colorless, non-toxic nature of its salts. Although certain principles are recognized for the selection of the proper aluminum alloy for specific uses, it is advisable in the case of new applications to test the selected alloy under actual working conditions prior to constructing the apparatus. The use of copper, brass, and other heavy metals in the same system with aluminum frequently produces serious electrolytic corrosion.

The most extensive use of lead in the process industries is found in the manufacture of sulphuric acid and other heavy chemicals. In this paper on this metal, G. O. Hiers of the National Lead Co. stated that when lead is alloyed with a few hundredths per cent tellurium, improved mechanical properties augment good corrosion resistance to produce a superior material of construction. Antimony, in amounts up to 28 per cent, improves the physical properties of lead.

In his survey of the precious metals as materials of construction, James A. Lee, managing editor of *Chem. & Met.*, stated that economic changes have greatly broadened the use of silver in chemical equipment. Silver equipment is generally made entirely of the one metal, 99.9 per cent fine silver being preferred to sterling silver or coin silver. The salvage value of silver equipment helps to compensate for its high initial cost.

Platinum, gold, palladium and tantalum are utilized for construction, but, in contrast to the lower cost materials, they are to be found in relatively small quantities and only in vital spots and for extreme conditions.



Pontalite, new water-clear plastic, strong as glass but flexible and non-shattering, is a polymerized methyl methacrylate developed by the Ammonia Department of duPont.

Chemical Engineer's BOOKSHELF

CO_2 in Industry

CARBON DIOXIDE. By *Elton L. Quinn* and *Charles L. Jones.* An American Chemical Society Monograph issued by The Reinhold Publishing Corp., New York. 285 pages. Price $7.50.

Reviewed by *G. T. Reich*

THIS IS THE FIRST BOOK of its kind in English that has appeared since the publication in 1907 of a book by Dr. J. C. Goosmann. It covers in an excellent manner the present status of the carbon-dioxide industry, not only from a scientific point of view, but from the practical side as well.

Chapters I and II are devoted to the history and occurrence of carbon dioxide in nature. Chapter III describes physical properties and chapter IV the chemical properties of carbon dioxide. The data in both of these chapters are quite complete, indicating the painstaking effort of the authors.

Chapter V deals with the effect of carbon dioxide upon the vital processes and is followed in chapter VI by a comprehensive discussion of the commercial manufacture of carbon dioxide. Chapter VII covers a field which is growing very rapidly, namely the manufacture and distribution of solid carbon dioxide. The concluding chapter deals in some detail with the commercial uses of the product.

The special training and experience of the authors in this field assure us that the book is authoritative and, furthermore, that it includes many sidelights on the industry not commonly found in the book literature. There are numerous references conveniently given at the bottom of each page, serving as a guide to those who may desire more detailed technical information. All of the important patents dealing with solid carbon dioxide, which have been issued here and abroad, are enumerated in the Appendix, which also includes physical data for the saturated liquid and vapor carbon dioxide.

In the opinion of this reviewer there might be included with profit, something on the comparative manufacturing costs and investments required for the various processes and materials. Important graphs on pp. 202 and 203 should have been larger to have been more useful. Also the description of processes used in the fermentation industry should be brought up-to-date in any subsequent revision. It is unfortunate, too, that some of the pictures were not clearly printed. A future volume should include analysis of and specifications for both liquid and solid carbon dioxide.

This book is by far the most complete and practical available in English on the subject of liquid and solid carbon dioxide. It is written in an interesting, suggestive and simple style and the typography is very good.

For Organic Chemikers

CHEMISTRY OF NATURAL PRODUCTS RELATED TO PHENANTHRENE. By *L. F. Fieser.* An American Chemical Society Monograph. Published by Reinhold Publishing Corp., New York. 358 pages. Price $7.50.

Reviewed by *W. L. Abramowitz*

IF THE PERVERSITIES of world economics have acted as depressants for general human activities, they seem to have been awed into negativity before the zeal of the organic chemists. The past six years have witnessed truly dramatic disclosures and brilliant investigations in a field where even laboratory samples could be obtained only with the greatest of difficulty. In the original work of Butenandt, for example, 4000 gallons of urine yielded only one-hundreth of a gram of hormone.

Morphine alkaloids, sex hormones, vitamin D, toad poisons, pine tree resins, and cancer producing substances have been reduced in greater part to the common structural foundation of phenanthrene. Of all this and of the biological aspects Fieser writes as lucidly as he lectures.

Those of us who still cling to visions of a tremendous gap between pure research and applied science may be surprised at the rapidity with which theoretical considerations in this instance have progressed into clinical successes. Approximately three months after Ruzicka's announcement of the preparation of the male hormone, the synthetic product was on the market. The book is a delight to the heart of the organic chemiker. Even the general reader will find it clear, stimulating, and instructive.

Odoriferous Materials

PERFUMES, COSMETICS, AND SOAPS, Vol. 1 Dictionary of Raw Materials, By *William A. Poucher,* Published by D. Van Nostrand, Inc., New York City. 439 pages. Price, $8.

ESSENTIAL OIL MEN, perfumers, and cosmetic manufacturers will like this new fourth edition of their bible. It has been extensively revised, many new substances are described, and the delineations of many of the older ones correlated with more recent data.

As readers in this field doubtless know, Volume 1 is an encyclopaedic listing of the essential oils, isolates, natural substances and synthetics which find use in the industry. Wherever possible, chemical and physical data, structural formulae, odors, and uses are given. In respect to the last, the type formulations generously presented, while not offered of course as artistic perfections, will be suggestive to the compounder. Numerous cross references are employed to good advantage. There are forty well chosen full-page illustrations.

The author has included four appendices of which the first, "Nomenclature of Synthetics," because of its excellent systemization, is a readily useful reference for organic structural terminology. The book as a whole is the best of its kind in the English language and should with its companion, Vol. 2 "Manufacture and Preparation," find its way to the bookshelves of everyone interested in perfumes, cosmetics, and soaps.

PERFUMES, COSMETICS AND SOAPS. Vol. II, 5th Edition. By *William A. Poucher.* Published by D. Van Nostrand Co., New York City. 426 pages. Price, $8.

Reviewed by *F. W. Muncie*

THIS practical and popular book needs no introduction to the professional worker in the fields of perfumery, cosmetics and essential oils. It has hitherto been possible to treat the sections on perfumery and cosmetics in a single volume. With the addition of new matter, it has become necessary to separate the two. Accordingly, the cos-

metic section of previous editions has been reserved for separate treatment, with Vol. II of this edition being devoted entirely to perfumery.

The most extensive addition of material occurs in the section containing monographs on flower perfumes. Following a visit by the author to Bulgaria, with an opportunity to gather new material at first hand, this subject has been considerably enlarged. It contains detailed information on the rose perfume industry, and particularly the production and composition of Rose Otto. The discussion will be read with interest by buyers and users of this important perfume.

The author has performed a practical service in adjusting his formulas to conform to the wide-spread use of industrial alcohol. Deference has been shown, too, to changing tastes in perfumes.

Appealing to the casual as well as the professional reader will be the large amount of interesting and curious information which has been gathered concerning flowers and perfumes and their use in earlier civilizations. In general, however, the work maintains its practical character as a treatise on the production, manufacture and use of perfumes, and, while no formal bibliography is appended, there are numerous references incorporated which might serve as a guide to further reading.

The volume is, like its predecessors, well gotten up. The paper is good, the print is clear, and there are 83 excellent illustrations.

Colloid Summary

COLLOID SYMPOSIUM MONOGRAPH. Papers presented at the Twelfth Symposium on Colloid Chemistry, Ithaca, N. Y., June, 1935. Edited by Harry Boyer Weiser. Published by the Williams and Wilkins Company, Baltimore, Md. 152 pages. Price, $3.

Reviewed by *F. E. Schmitt, Jr.*

THIS book, as the subtitle will indicate, contains the papers presented at the annual colloid symposium. These represent the latest developments, the interim reports on work as yet incomplete, and discussions of established theory in the light of new data. Of particular interest to colloid chemists is the paper by Weiser and Milligan, who applied X-ray analysis to prove in neat fashion that the stability of hydrous oxide sols is not due to Werner complexes of oxide and electrolyte; and the paper by Damerell and Tower on a proposed hydrate decomposition mechanism. The book is one good way to obtain a review of recent thinking and methodology in the colloid field, and should prove a stimulating addition to any colloids library.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Oleomargarine — Statistics of Production, Materials Used in Manufacture, Consumption Trade, and Prices, by Anne Dewees. Bureau of Agricultural Economics; mimeographed, August, 1936.

State and Federal Legislation and Decisions Relating to Oleomargarine, by Anne Dewees. Bureau of Agricultural Economics, June, 1936; mimeographed.

Taxes on Oleomargarine, Adulterated Butter, and Process or Renovated Butter. Bureau of Internal Revenue Regulations No. 9; 10 cents.

Rules of Practice Before Interstate Commerce Commission in Proceedings Under Interstate Commerce Act and Related Acts, with Approved Forms; Revised to April1, 1936. Interstate Commerce Commission unnumbered document; 10 cents.

The Shifts in Sources of Chromite Supply, by R. H. Ridgway. Bureau of Mines Information Circular 6886; mimeographed.

Design and Operation of a Four-Ton-Per-Hour Gold and Silver Ore Sampling Plant, by E. D. Gardner and W. A. Leddell. Bureau of Mines Information Circular 6891; mimeographed.

Questions and Answers on First-Aid Training, by J. J. Forbes and M. J. Ankeny. Bureau of Mines Information Circular 6853, Second Edition; mimeographed.

Wage Data. Analysis of Production, Wages and Employment in the Manufacturing Industries, 1914-1933, prepared by the Council for Industrial Progress, covering the following industries: Food and Kindred Products; Stone, Clay, and Glass Products; Iron and Steel and Their Products (Not Including Machinery); All Manufacturing Industries; Non-Ferrous Metals and Their Products. These mimeographed documents are available from the office of the Coordinator for Industrial Cooperation, Tower Bldg., Washington, D. C.

Minerals Yearbook, 1936. Bureau of Mines, 1136 pages, cloth bound; $2.00. Mineral resources data with statistics for the year 1935.

Flameproofing of Textiles. Bureau of Standards Letter Circular 467; mimeographed.

World Economics. World Economic Review, Bureau of Foreign and Domestic Commerce unnumbered document; 50 cents. The balance of International Payments of the United States in 1935, Bureau of Foreign and Domestic Commerce Trade Information Bulletin 833; 10 cents.

Book Cloths, Buckrams, and Impregnated Fabrics for Bookbinding Purposes Except Library Bindings. Bureau of Standards, Commercial Standard CS57-36; 5 cents.

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Discussion of Industrial Accidents and Diseases. Department of Labor, Division of Labor Standards Bulletin No. 4; 20 cents.

Federal Register. Daily announcements of important official findings of the U. S. Government, available through subscription from the Director of the National Archives; $10.00 per year.

Basic Industrial Markets in the U. S.— The Textile Industries. Bureau of Foreign and Domestic Commerce, Market Research Series No. 14.1; mimeographed, 10 cents.

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The French System of Taxation. Bureau of Foreign and Domestic Commerce, Division of Commercial Laws, C.D. No. 579; mimeographed, 5 cents.

The Insurance Enterprise Law Promulgated by the National Government Republic of China. Bureau of Foreign and Domestic Commerce, Division of Commercial Laws; mimeographed.

Potential Water Power in the United States. Department of the Interior Memorandum for the Press, Released August 20, 1936; mimeographed.

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Distribution of the Argentine Ant in the United States and Suggestions for its Control or Eradication, by M. R. Smith. Department of Agriculture Circular No. 387; 5 cents.

Milk-Sanitation Status of Urban Communities. Public Health Service Reprint No. 1729; 5 cents.

Apparatus for Placing Test Lots of Insects Within Parcels of Stored Tobacco During Fumigation Experiments, by W. D. Reed and others. Bureau of Entomology and Plant Quarantine ET-83; mimeographed.

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Your Plant NOTEBOOK

THESE CHARTS SOLVE ORIFICE EQUATIONS

By James E. Pierce
Physical Research Laboratory, Dow Chemical Co.
Midland, Mich.

TWO ALIGNMENT CHARTS that have been developed in the Physical Research Laboratory of the Dow Chemical Co., for use in solving orifice equations for a variety of densities of both liquids and gases, have proved extremely useful, both in choosing a suitable orifice size for a given flow and in calibrating manometers used for the measurement of flow of various fluids. Fig. 1 covers the flow of liquids of specific gravities ranging from 0.6 to 3.0, with orifices from 0.1 to 1.0 in. diameter. As an example, to find the gallons of 1.5 sp. gr. liquid that will flow per hour through a ½-in. standard orifice when the manometer reading is 45 in. w.g., connect 1.5 on the specific gravity axis to 45 in. on the manometer reading axis and extend the line so designated to the reference line. Connect the point intersected on the reference line with ½ in. on the orifice diameter axis, reading the intersection of the liquid flow axis as 272 gal. per hour.

The chart of Fig. 2, which covers the flow of gases ranging in density from 0.005 to 2.0 lb. per cubic foot, through orifices of the same size range as Fig. 1, is used in the same manner. To determine the cubic feet per hour of a 1.35-lb. per cubic foot gas flowing through a ½-in. orifice when the manometer reading is 81 in. w.g., connect 1.35 on the density axis with 81 in. on the manometer reading scale, extending the line to its intersection with the reference line. From this intersection draw a line to the ½-in. point on the orifice diameter axis, intersecting the flow axis at 425 cu. ft. of gas per hour.

Fig. 1—Nomograph for determining flow of liquids

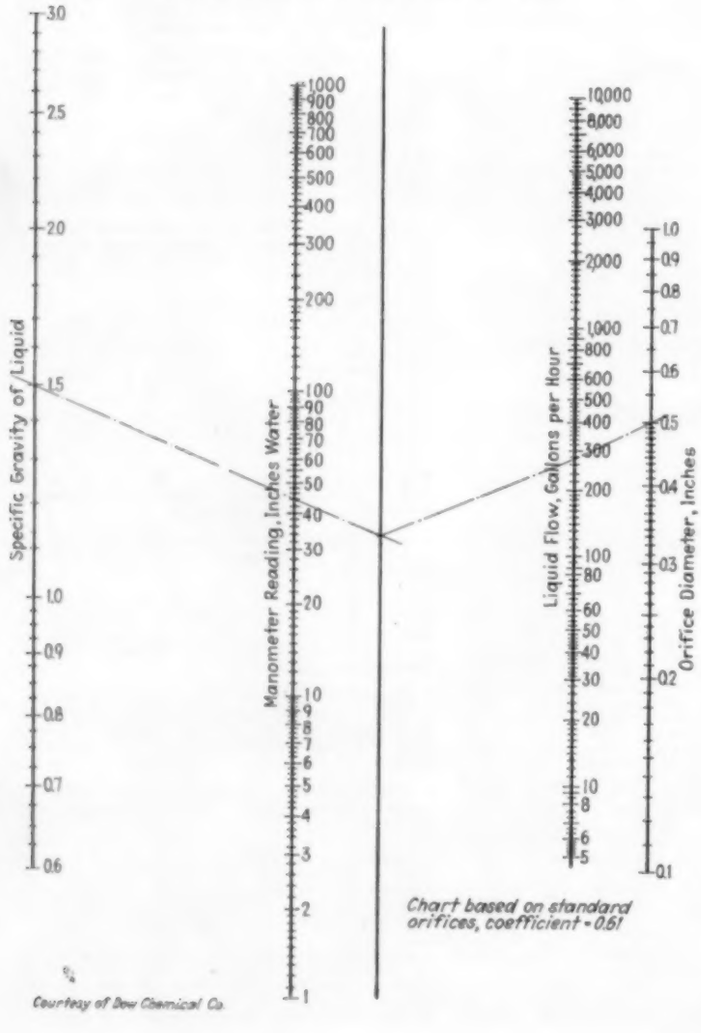
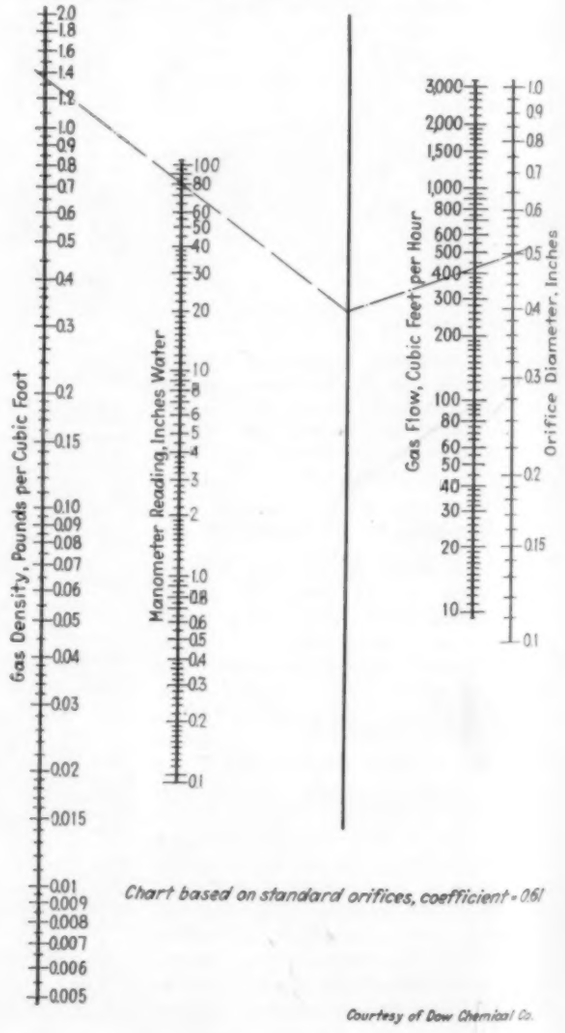

Specific Gravity of Liquid
Manometer Reading, Inches Water
Liquid Flow, Gallons per Hour
Orifice Diameter, Inches
Chart based on standard orifices, coefficient = 0.61
Courtesy of Dow Chemical Co.

Fig. 2—Nomograph for determining flow of gases


Gas Density, Pounds per Cubic Foot
Manometer Reading, Inches Water
Gas Flow, Cubic Feet per Hour
Orifice Diameter, Inches
Chart based on standard orifices, coefficient = 0.61
Courtesy of Dow Chemical Co.

News of EQUIPMENT

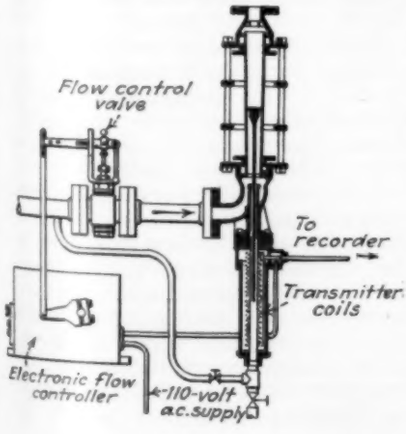
Flow Controller

Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa., has recently developed a new electronic flow controller for use in conjunction with its Rotameter flowmeter. The new controller is intended for use in automatically maintaining the flow of liquids, vapors or gases in piping systems at any desired fixed rate. As shown in the drawing, the Rotameter rotor controls the position of a magnetic armature rod which moves within a divided transmitter coil attached to the Rotameter body. This coil is connected electrically to the control unit which contains a divided receiving induction coil and a grid-controlled electronic circuit, the latter supplying the power to a drive motor which is connected mechanically to the flow control valve. In a modified form, the controller motor operates a pilot air valve to control an air operated valve in the fluid line. This arrangement is used when it is desired to keep motors or other electrical equipment away from the process flow line. With this type the controller can be located at any desired distance from the air valve and Rotameter, and can be placed in a vapor-proof case. With either arrangement a recorder can be furnished, if desired.

The new flow controller embodies in its design a trend analyzing system which causes the restorative movement made by the control valve to be rapid when deviation from the desired control point is great, becoming slower as the control point is approached. Finally a series of micrometer movements brings the valve to rest at exactly the correct position. The entire change takes place in a few seconds' time, however, even when large corrections of the valve position are required.

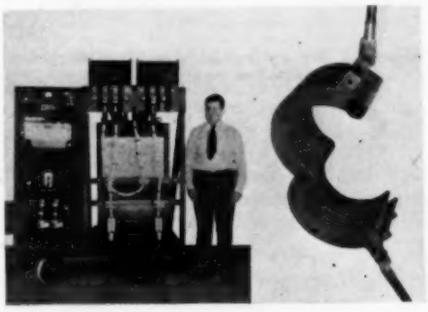
Adjustments are provided for sensitivity so that the controller can be set to take care of any particular process requirement. Hunting is said to be entirely eliminated.

Typical installation of Rotameter with flow controller



Joint Stress Reliever

Welding of steel pipe is equivalent to casting a ring of weld metal in intimate contact with the pipe ends, at a temperature considerably higher than that obtaining in the pipe at points near the weld. As a result, stresses are developed in the region of the weld which may result in failure when the pipe is put into service. By heating to a suitable temperature, the plastic flow which takes place in the joint relieves the stress while, at the same time, a drawing or tempering action takes place, increasing the ductility of the weld metal by as much as 50 per cent and increasing its impact strength from 10 to 15 per cent.



Heating coil for relieving pipe weld stresses, together with transformer and auxiliary equipment

Investigations have shown that a temperature of 1,100-1,200 deg. F. is the most desirable stress relieving range. It has been found, however, that the weld and adjacent pipe metal must be raised uniformly to this temperature, held for a specific period of time and cooled uniformly at a given rate. A method for accomplishing these results in the field has recently been developed and introduced commercially by the Detroit Electric Furnace Co., 825 West Elizabeth St., Detroit, Mich. The equipment consists essentially of a portable, low-frequency heating coil and protective insulating shield, both hinged so that they are readily clamped around the pipe weld. By this means heat is developed in the weld metal and in the necessary length of pipe. A tap-change transformer, with auxiliary equipment for controlling electric energy supplied to the heating coil, and a controlling pyrometer, are mounted on a portable hand truck. Any 60-cycle power supply of about 100 kva. capacity is a satisfactory power source. The thermocouple is attached to the weld and to the controller. The coil is mounted around the weld to be relieved and secondary cables are connected to the coil. Correct voltages for the proper heating rate can then be secured by making proper connections on the tap changes.

If desired, the rate of cooling can also be controlled by keeping the coil energized at a lower voltage to meet any special conditions of cooling which may be required.

Remote-Control Unloader

Many improvements and refinements have been made by the Fuller Co., Catasauqua, Pa., in the new Fuller automatic remote-control unloader. The machine is intended for unloading and conveying portland cement and other dry, pulverized materials. Owing to its remote control feature, it can be operated from a safe distance, also permitting the operator to leave the machine while it is in operation to clean the floor of residue material. Delivery of material is maintained at a constant maximum rate by permitting the operator to force the operation, as the necessity for rearwise movement in anticipation of slides is eliminated. The machine will function efficiently, according to the manufacturers, even though it may be

Remotely controlled unloader withdrawing cement from storage

buried entirely under a slide of material.

The machine feeds automatically, and can be made to move forward, backward or to either side, under control of a switch held in the operator's hand. A separate button controls the pump operation, independently of the movements of the machine.

Non-Cooled Furnace Valve

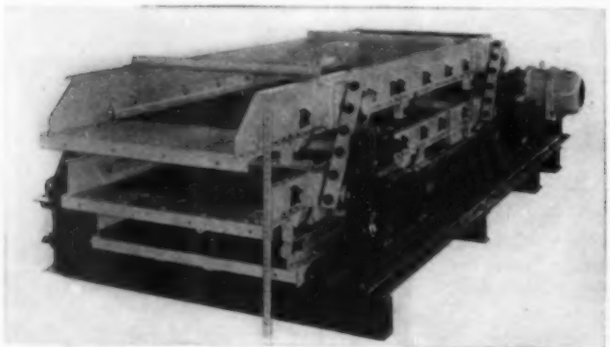
Freyn Engineering Co., 310 South Michigan Ave., Chicago, Ill., has recently announced the new Freyn-Fahrite non-cooled furnace valve, which comprises a heat-resisting alloy-steel seat and gate inclosed above the floor level with a steel plate housing on which is mounted an integral, motor-driven operating mechanism for raising and lowering the gate. The alloy used is Fahrite, a heat-resisting chrome-nickel steel capable of withstanding high temperatures, and especially resistant to chemical attack. The gate is of sectional construction, the sections being mounted on a central stem to permit their independent expansion and contraction and prevent warping. They are, however, interlocked with each other so as to prevent leakage.

The construction has been developed for use in steel plants but it appears that it may be equally useful in chemical furnace applications owing to its simplicity, freedom from extraneous parts, and resistance to severe conditions. For use in a reversing system, two valves may be used together with any desired sort of electrical interlock. For instance, it is possible to interconnect the motors so that the motor of the valve being closed acts as an induction generator, returning power to the line and supplying what power is necessary to open the other gate, with the exception of friction, and electrical losses in the motors.

Double-Action Screen

A new screen operating on a level plane, which is given a motion combining shaking and whipping, has been announced by the Hendrick Mfg. Co., Carbondale, Pa. Owing to the level operation of the new screen, specially inclined supports are not required. Very little headroom is needed and, if desired, the screen may be supported from overhead. This construction is available in both two- and three-deck models, in widths from 3 to 5 ft. and lengths up to 20 ft.

Double-action shaking screen



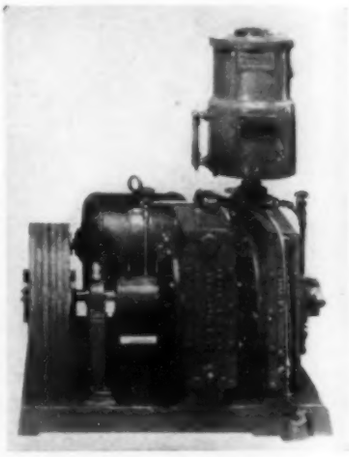
Foam-Making Nozzle

A water stream can be converted into a continuous foam stream by a mechanical (rather than a chemical) method, utilizing equipment recently announced by the Pyrene Manufacturing Co., Newark, N. J. This device is known as the Phomaire Play Pipe. It is a special form of nozzle, available for sizes of hose from ¾ to 2½ in., and so designed that as water passes through it, Phomaide foam-making solution and air are automatically drawn into the water stream in proper proportions to form foam for the fighting of flammable liquid fires. The Phomaide solution is carried by the operator in a hip container. Water must be supplied with a pressure of 75 lb. or more at the play pipe, but only about 20 gal. of water per minute is required. One gallon of the solution makes 350 gal. of foam.

Gasoline fire extinguished with Phomaide solution and water

High Vacuum Pump

Two cylinders, cast integral, are employed in a new two-stage, high vacuum pump recently announced by Beach-Russ Co., 50 Church St., New York City. This construction is said to give added simplicity and to minimize any tendency towards leakage between the first and second stages. The design is compact, occupying a minimum of floor space. Standard capacities range from 8 to 200 cu. ft. per minute. In applications such as distillation and vacuum filtering, where moisture is likely to be present in the gases exhausted, the pump is guaranteed to maintain a vacuum within 1 mm. of absolute. For such applications it is equipped with this company's new water-oil separator which has been designed to collect and discharge all accumulated water without affecting the vacuum produced. The pump is built in various corrosion resisting metals, depending on requirements.



Two-stage integral vacuum pump

Equipment Briefs

Manhattan Rubber Mfg. Division, Raybestos-Manhattan, Inc., Passaic, N. J., has announced that patents have recently been granted covering its radioactive treatment of fire hose. The new process involves the use of rare-earth metal salts having radio-active properties, which are said effectively and permanently to resist mildew and make the hose moisture repellant, rot and freeze-proof.

A new type of flashlight, incorporating a special form of inertia-operated switch, which operates with a flick of the wrist, has recently been put on the market under the name of Megolite by Inertia Devices, Inc., 370 Broadway, Albany, N. Y. A number of these lights are said to have been under water for several days during the recent Pittsburg flood, without damage. Megolites have been approved by the U.S. Bureau of Mines for safety in methane and air mixtures. They employ a case which is completely sealed, made of a corrosion-resisting insulating material said to be practically indestructible.

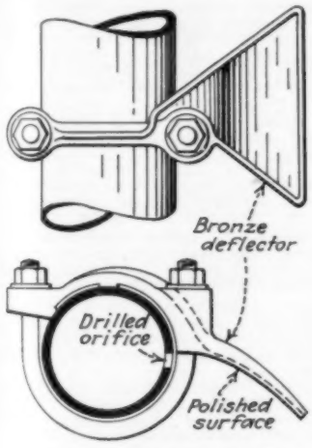
A new device for silencing air compressors, the Protectomotor Silence-Filter, has recently been announced by the Staynew Filter Corp., Rochester, N. Y. As the name implies, the new device comprises both a silencer and a filter, the combined result being obtained by drawing the air into the unit through a series of cylindrical rectifying chambers which are welded air

tight to a supporting base. Air is then distributed at a much lower velocity to the filtering element. It is said to be this sudden lowering of air velocity which silences the intake.

Eastern Engineering Co., 45 Fox St., New Haven, Conn., has recently developed a new line of portable electric mixers for general industrial application. These mixers employ nickel-plated cast bronze propellers and 30-in. stainless steel shafts (Monel metal shafts and propellers are available) and are provided with continuous-duty motors and heavy iron clamps for attaching the mixer to the vat. They are available in ¼ and 1/20 hp. designs.

Non-Clog Spray

A non-clogging spray nozzle recently introduced by the Link-Belt Co., 300 West Pershing Road, Chicago, Ill., consists of a specially shaped, smoothly polished, curved bronze deflector with a U-bolt for clamping it securely to a water pipe in such position that the



Plan and elevation of new nozzle

deflector casting is just above a small orifice drilled in the wall of the pipe. This nozzle is made in two standard sizes, for assembly on 1½ and 2½ in. diameter pipes. The diameter of orifice can be made of proper size to suit the pressure and volume of water.

Among the uses suggested for the new nozzle may be mentioned the cleaning of water-intake screens and the spraying of vibrating screens.

This company has also introduced a new form of control for the power-operated shovels, draglines and cranes of its manufacture. This new control, known as the Speed-O-Matic, harnesses a small fraction of the power of the machine to supply the force ordinarily provided manually for operating the various controls. A number of short easy-throw levers are grouped before the operator, eliminating fatigue, speeding operation and increasing output, according to the manufacturer.

Improved Sulphur Cements

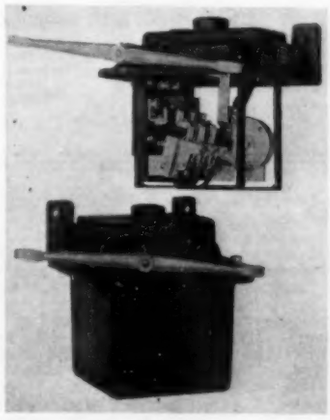
A number of sulphur cements improved in accordance with the methods developed by the Texas Gulf Sulphur Co.'s multiple fellowship at Mellon Institute, and described by W. W. Duecker in the November, 1934, issue of *Chem. & Met.*, have now been introduced commercially by the Atlas Mineral Products Co., Mertztown, Pa. Compositions otherwise similar to those previously made by this company now contain in addition rubber-like olefine polysulphides (Thiokol), which are soluble in sulphur and have the property of making the cements many times more resistant to mechanical and thermal shock, without detracting from their acid resistance. The improved cements are stated also to possess greater bonding strength to metallic and ceramic surfaces and to have coefficients of thermal expansion approximately one-third those of ordinary sulphur cements.

The first of these products, Tegul-Vitrobond, is used for setting acidproof masonry linings in rubber-lined steel tanks, steel tanks, and concrete tanks and in the construction of all-masonry acidproof equipment. Tegul-Tileset is a cement compounded especially for the construction of acidproof floors. The material is applied in the molten state and when solidified is claimed to produce a permanently acidproof joint which is practically non-absorbent. Tegul-Mineralead, the improved form of the cement described in the November, 1930, issue of *Chem. & Met.*, is used for the construction of bell and spigot joints in cast iron and ceramic pipes.

Float Switch

For use in corrosive atmospheres or hazardous areas, and particularly where weatherproof, dust-tight construction is advantageous, the Rowan Controller Co., Baltimore, Md., has developed a new explosion-proof oil-immersed float

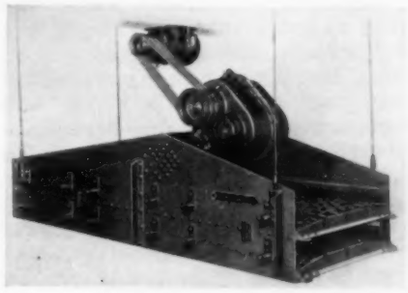
Assembled and stripped views of float switch



switch for controlling the operation of sump pumps and similar equipment. The new switch is of rugged construction and is equipped with renewable contacts. The operating mechanism is easily accessible and the equipment is adapted to operate in maintaining either a high or a low liquid level.

Vibrating Screen

New sizes and types have recently been added to the line of low-head, horizontal vibrating screens manufactured by Allis-Chalmers Mfg. Co., Milwaukee, Wis. These screens are now available in single, double and triple deck designs, in various sizes up to and including 6 ft. wide. Being horizontal, the new screens require a minimum of headroom, resulting in reduced building heights, reduction in the length of accessory elevators and conveyors, and a corresponding saving in power. The vibratory action transmitted by the mechanism, which can be located either below or above the screen, results in the material being agitated and conveyed over the screen toward the discharge, giving, it is said, high screening efficiency.



Double-deck low-head vibrating screen

New Instruments

Model 6088V is the designation of a new process cycle controller, recently developed by The Bristol Co., Waterbury, Conn., for cycle control in all cases where a variable speed controller is required. The instrument is equipped with a single cam operating one or two three-way pilot valves. The cam is readily adjustable to carry out any desired time cycle within the scope of the instrument. A two-speed cam-operating mechanism makes possible a multiplicity of speeds obtainable with but a single cam. No gear-shift, governors, springs or escapements are used in this mechanism.

Recent developments of the Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill., include a redesigned line of CO_2 meters and an improved recording thermometer. The new thermometers feature the "cartridge-sealed" construction now used in most of this company's equipment. The gas-filled

sensitive system employs a helical coil sealed within a casing. The coil is welded to the capillary tubing and the tubing to the sensitive bulb so that the entire unit can readily be removed from the reading instrument for recalibration or repair.

The improved CO_2 meter operates on the Orsat principle, is driven by a fractional horsepower electric motor and requires no water for its operation. The large caustic tank holds enough potash to last from 4 to 6 months. Temperature variations are said to have no effect on the meter readings. A filter in the gas line removes all SO_2 from the flue gas.

A new room thermostat designed particularly for use with unit coolers and unit heaters, but also available for duct installation, has been announced by the Wilbin Instrument Corp., 40 East 34th St., New York City. Owing to the use of a sensitive fluid expansion thermostatic system of large capacity, coiled in the perforated case, the new instrument is said to show extremely rapid response to temperature changes and to have a differential which can be made as small as ½ deg. F. The current contacts can handle 1,000 watts without a relay.

New controllers for such process variables as temperature, flow, liquid level and pressure, for applications where a broad throttling range is required and load conditions fluctuate widely, have been announced by The Bristol Co., Waterbury, Conn. The new controller is known as the Master Free-Vane and operates according to this company's basic Free-Vane system. It is equipped with sensitivity adjustment, automatic reset, and accessory features to minimize hunting.

Conical-Hole Plates

Availability of perforated screen plates with conically shaped holes, which avoid the clogging common with cylindrical holes, has been announced by Abbe Engineering Co., 50 Church St., New York City. Among the special features of these plates is the fact that plates can be supplied in thicknesses in many cases far greater than the hole diameter. Openings as small as 0.01 to 0.02 in. can be provided in hard steel and in stainless steel. Plates can be supplied with full conical holes or with holes half conical and half cylindrical. The full conical hole is said to be particularly well adapted to pulverizing and grinding.

Equipment Briefs

Markal is the name of a new paint in stick form, produced in two varieties, one for hot and one for cold marking. It is marketed by Helmer and Staley, 2579 South Parkway, Chicago, Ill., can be applied to either wet or dry surfaces and is said to be as permanent as other paints. It hardens only after being marked onto surfaces such as wood, metal, glass or stone, and does not dry out as long as it remains in stick form.

Having an efficiency of 25–30 watts per lumen and an operating life rating of 2,000 hours, a new 250 watt mercury vapor lamp has been announced by the General Electric Vapor Lamp Co., Hoboken, N. J., and the Incandescent Lamp Department at Nela Park, Cleveland, Ohio. It is of much smaller dimensions than the previously introduced 400 watt lamp and can be used alone, or in combination with incandescent lamps if artificial daylight is desired.

Michigan Steel Castings Co., Detroit, Mich., has announced the successful development of centrifugally cast stainless steel pipe. This pipe is cast in a revolving mold and is available in outside diameters from 2 to 22 in. and in wall thicknesses from ⅛ in. upwards. A number of chromium-nickel, nickel-chromium, and iron-chromium alloys are used for this pipe.

A new motor-driven, single-operator type arc welder for general fabrication and repair work, featuring burn-out-protected insulation, has been developed by the Lincoln Electric Co., Cleveland, Ohio. This machine, designated as Type SA-150, has a rated current capacity of 45 to 200 amp. It is intended for sheet metal work, hard facing, pipe welding, cast iron repair, and similar work. It can be used with either bare or coated electrodes.

MANUFACTURERS' LATEST PUBLICATIONS

Alloy Castings. Michiana Products Corp., Michigan City, Ind.—16-page booklet describing this company's corrosion resistant and stainless steel alloys, and castings produced from them. Covers properties and uses.

Blowers. Ilg Electric Ventilating Co., 2850 North Crawford Ave., Chicago, Ill.—Catalog FB-45—64-page book describing a wide variety of self-cooled-motor propeller fans, blowers and accessories, with data.

Bolts. H. M. Harper Co., 2620 Fletcher St., Chicago, Ill.—48-page catalog and price list of bolts, nuts, screws and washers manufactured by this company in a wide range of non-ferrous metals and alloys and in stainless steel.

Disintegration Equipment. Paul O. Abbé, Inc., Little Falls, N. J.—Catalog Q—12 pages briefly describing this company's complete line of rotary cutters, cage, attrition and disk mills.

Disintegrating Machinery. J. H. Day Co., Cincinnati, Ohio—Bulletin 370—12 pages describing crushers, disintegrators, pot mills, ball mills, stone mills, pharmaceutical and roller mills made by this company.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 1179—36 pages on steam turbines in capacities ranging from 500 to 5,000 kw.; also Bulletin 1478, 8 pages on this company's low-head vibrating screens.

Equipment. The Dorr Co., 570 Lexington Ave., New York City—Bulletin 7061—30 pages with useful table of conversion factors—informally describing this company's equipment for chemical and industrial processing, including agitators and mixers, classifiers, thickeners and flocculators.

Equipment. Edge Moor Iron Works, 30 Rockefeller Plaza, New York City—Bulletin 101—8 pages descriptive of some of the fabricated process equipment made in various metals by this company.

Equipment. Link-Belt Co., 307 North Michigan Ave., Chicago, Ill.—Publications as follows: Catalog 1562, 24 pages on vibrating screens made by this company; Catalog 1569, folder describing this company's new Speed-O-Matic control for shovels, cranes and draglines; Folder 1587, 8 pages on mechanically cleaned bar screens for sewage.

Equipment. Seamless Steel Equipment Corp., 39 Broadway, New York City—Catalog K—48 pages illustrating and describing a variety of forged, rolled and drawn seamless steel products made by this company for service at high pressures and temperatures.

Flanges. Kropp Forge Co., 5301 West Roosevelt Road, Chicago, Ill.—24-page book describing and giving dimensions of stock forged flanges in many types and sizes, made by this company.

Instruments. Cochrane Corp., 17th St. below Allegheny Ave., Philadelphia, Pa.—Bulletin 2096—12 pages completely describing this company's electric flowmeters.

Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin 194-1—Describes in comprehensive fashion principles and application of this company's Stabilog potentiometer control pyrometer. Also, new revision of original 1931 publication, "Handbook of Steam Flow Measurement," a 70-page reference manual on steam flow.

Insulation. Keasbey & Mattison Co., Ambler, Pa.—Illustrated catalog covering properties and uses of asbestos and magnesia products with information on lightweight ceiling, wall and partition construction, on asbestos lumber, insulating and refractory cements, and other materials.

Mill Drive. Patterson Foundry & Machine Co., East Liverpool, Ohio—Leaflet describing this company's new mill drive with magnetic brake and inching device.

Motors. Lincoln Electric Co., Cleveland, Ohio—Bulletin 206—6 pages of engineering pointers on the application, selection and installation of totally-inclosed, fan-cooled motors.

Nozzles. Monarch Manufacturing Works, Salmon & Westmoreland Sts., Philadelphia, Pa.—Catalog 6-A—6 pages with engineering data, listing and describing some of the types of spray nozzle made by this company.

Ovens. Dispatch Oven Co., 622 Ninth St., S. E., Minneapolis, Minn.—Bulletin 620—Leaflet describing this company's forced-draft electric oven for laboratory use, with guaranteed 1 deg. C., plus or minus, control.

Plastics. Bakelite Corp., 247 Park Ave., New York City—Bakelite Molded, 7th Edition—48 pages on Bakelite molding materials and their uses for a wide variety of electrical, mechanical and chemical purposes.

Plastics. General Plastics, Inc., North Tonawanda, N. Y.—12-page booklet discussing resins, impregnating and coating solutions, adhesives, resin emulsions and colloids, and flexible resins made by this company.

Pumps. Morris Machine Works, Baldwinsville, N. Y.—Bulletin 162—4 pages on screw pumps made by this company. Also Bulletin 161, 4 pages on non-clogging centrifugal pumps for sewage and industrial service.

Refractories. Quigley Co., 56 West 45th St., New York City—Bulletin 321-A—Leaflet describing Cast-Refract, this company's castable refractory for making special shapes.

Thiokol. Thiokol Corp., Yardville, N. J.—Bulletin D-2—12 pages completely describing properties and uses of Thiokol D synthetic rubber.

Tubing. Carpenter Steel Co., 347 Madison Ave., New York City—8 pages on forms, properties and uses of this company's stainless steel welded tubing.

Ventilation. The Swartwout Co., 18511 Euclid Ave., Cleveland, Ohio—Bulletin V-100-B—16-page booklet on ventilation, with particular reference to this company's natural ventilation system for factory and other buildings.

Chemical Engineering NEWS

Safety Council Will Meet In Atlantic City

THE Twenty-Fifth National Safety Congress and Exposition of the National Safety Congress will be held at Atlantic City, N. J., Oct. 5-9. The Chemical Section of which A. L. Armstrong, Eastman Kodak Co., Rochester, N. Y., is general chairman will open its sessions on Tuesday morning, Oct. 6 in Chelsea Hotel. Following the message from the general chairman, John S. Shaw, manager of the safety and service department of Hercules Powder Co., Wilmington, Del., will present a paper on "Instructional Training or Fundamentals of Safety That Every Chemical Worker Should Know." Then will come a round table discussion on "Safety Educational Methods" led by John Roach, Deputy Commissioner of Labor of New Jersey.

On Wednesday morning, Oct. 7, J. W. Newton, of the compensation and claims department of Eastman Kodak Co., will speak on "New Legal Aspects of Chemical Industry Hazards." A general discussion will follow after which officers for the ensuing year will be selected.

Monday afternoon, Oct. 5, will be Chemical Section Day at the Exposition. Hundreds of products of unusual interest connected with safety equipment and services will be on display in the ballroom of the Atlantic City Auditorium.

Grasselli Will Increase Pest Control Research

EXTENSIVE research in agricultural and other pest control will be carried on by a staff of scientists in a laboratory and greenhouse now under construction for The Grasselli Chemical Co., at the du Pont Experimental Station, Wilmington, Del. The structures will be completed and equipped within the next few months.

The pest control research activities have been reorganized in the chemical department of The Grasselli Chemical Co., of which E. A. Taylor is director, and transferred from Cleveland to Wilmington. Research has been organized as a separate division with Dr. W. H. Tisdale in charge.

Sales introduction of insecticides, fungicides and other products developed in the new laboratory will come under the new products division of The Grasselli Chemical Co., Cleveland. E. B. Alvord is manager of the division.

The present staff of entomologists, plant pathologists and chemists of the Pest Control Research Division will be increased when the new laboratory is ready for occupancy.

Consolidation of the pest control research work of the Grasselli company and co-ordination of the activities of biologists and chemists working on pest control at the du Pont Experimental Station were among the reasons for locating the laboratory and other facilities at Wilmington. Direct contact will be established with the staff and laboratories of the Experimental Station which is the central chemical research organization of the du Pont company. Federal and state agencies which have been co-operating with the Grasselli group will be asked to continue the assistance given in pest control activities.

Infringement of Activated Carbon Patents Affirmed

A DECISION rendered by the United States Circuit Court of Appeals for the Second Circuit August 10, 1936, affirmed the decree of the United States District Court for the District of Connecticut May 13, 1935, which held that certain claims of U. S. patents Nos. 1,497,543 and 1,497,544, covering activated vapor adsorbent carbon, were valid and infringed. The suit was brought by National Carbon Co., Inc., unit of Union Carbide and Carbon Corp., against Richards & Co., Inc., and The Zapon Co., of Stamford, Conn., because the two latter companies were using for solvent recovery activated coconut carbon which had been made by The Barnebey-Cheney Engineering Co., of Columbus, Ohio. United States District Judge Hincks held that this constituted infringement of the plaintiff's patent claims which he found valid. He rendered judgment in favor of the plaintiff for $24,410.65 on account of the infringement.

In rendering the decision affirming the decree of the District Court, Circuit Judge Swan stressed the fact that the defendants were not charged with infringement of the patented process but with infringement of certain product claims by the use of infringing carbon in their business.

The Chaney patents were based on the wartime discoveries of Dr. N. K. Chaney and his associates in the National Carbon Co., Inc.—discoveries that assured an ample supply of efficient gas-mask carbon at a time when the need was most urgent. After the war, it was found that this activated carbon was equally efficient for a variety of peacetime uses. In 1919, the National Carbon Co., Inc., began the manufacture of activated carbons by the Chaney process for industrial use.

Columbia Alkali Enters Liquid Chlorine Field

A COMPLETE new plant, modern in every detail has been completed at Barberton, Ohio, for the Columbia Alkali Corp., wholly owned subsidiary of Pittsburgh Plate Glass Co. The new plant which is already in operation, is producing liquid chlorine and electrolytic caustic soda. For nearly half a century, Columbia has been a prominent factor in the alkali industry and the new construction adds liquid chlorine to its list of products. The new plant is located on the company's property at Barberton but it is a detached unit and has been so constructed that additional units may be added when expansion becomes necessary.

Minerals Yearbook Ready For Distribution

PUBLICATION of the "Minerals Yearbook, 1936," is announced by the United States Bureau of Mines. The volume contains 69 chapters, 154 illustrations, and 1,136 pages, and provides in convenient form a comprehensive and accurate record of economic developments and trends in the mineral industries of the United States during the year 1935. In addition to a presentation of the fundamental statistics of the production and marketing of a hundred commercial minerals, world production of minerals and the economic aspects of international mineral policies are reviewed.

Chemurgic Conference In Louisiana

UNDER the joint auspices of the Beaumont, Texas and Lafayette, La., Chambers of Commerce a Southern Conference of the Farm Chemurgic Council will be held at Lafayette on Oct. 15-17.

The tentative program calls for the first general session on Thursday morning, Oct. 15, in Martin Hall, Southwestern Louisiana Institute. P. B. Doty will preside and an address of welcome will be delivered by Governor Richard W. Leche to which Dr. Thomas O. Walton will respond. Other speakers will include Carl B. Fritsche, Francis P. Garvan, and Dr. Henry G. Knight. After luncheon, the afternoon will be devoted to a tour of the Evangeline country.

Cotton and its byproducts will furnish the theme for the session on Friday morning, Oct. 16, with Victor Shoffelmayer as the presiding officer. An address on "Cotton in the Social and Economic Life of the South" will be given by N. C. Williamson. Papers also will be read by Dr. Warren E. Embly, Francis Hickman, Dr. H. S. Willis, Charles K. Everett, Henry Stevens, Dr. J. S. Abbott, and A. L. Ward. In the afternoon sugar cane and its byproducts will be the topic under discussion with the following speakers: C. D. Kemper, Dr. W. L. Owen, Dr. T. B. Munroe, Walter Godchaux, and Dr. H. E. Barnard.

The banquet will be held in Southwestern Louisiana Institute dining hall on the evening of Oct. 16. The toastmaster will be Francis P. Garvan and speakers will include: Wheeler McMillen, Dr. Charles H. Herty and James A. Lee.

The final session on Saturday morning, Oct. 17, will be given over to talks on the industrial potentialities of rice, sweet potatoes, wood pulp, naval stores, and tung oil. Speakers will be: Frank Gould, H. E. Gardner, W. N. Reid, Capt. I. F. Eldredge, Dr. H. S. Paine, Dr. Charles H. Herty, and C. C. Concannon.

A.I.M.E. Metals Divisions Fall Meeting

THE Institute of Metals and Iron and Steel Divisions of the American Institute of Mining and Metallurgical Engineers will hold their fall meetings at Cleveland, Ohio, Oct. 20-22, joining with the American Society for Metals, the American Welding Society, the Wire Association, and the American Society for Mechanical Engineers in the observance of National Metals Week.

The technical sessions of both Divisions of the A.I.M.E. will be held at the headquarters hotel, the Statler Hotel, except that the Wednesday afternoon sessions will be at the Cleveland Public Auditorium, the scene of the National Metals Exposition. The Iron and Steel Division will have sessions on Blast Furnace Practice, Open Hearth Steel Plant and X-ray Metallography; the Institute of Metals Division on Aging of Metals and Constitution of Alloy Systems; the two divisions will join in morning and afternoon sessions on Thursday for a Round Table Discussion of Physical Tests and their Significance.

The dinner of the metals divisions will be held at the Statler Hotel on Wednesday evening, Oct. 21. Albert Sauveur will be the principal speaker.

The A.I.M.E. will have a booth at the National Metals Exposition near the main entrance, a convenient place for members and friends to meet as they enter or leave the metals show. There will be an interesting exhibit of metallic minerals, common and rare metals, typical uses of metallic elements, a series of charts illustrating the sources of the more important commercial metals and their flow in world trade, all illustrating the ramifications of the mineral and metal industries and typifying the scope of A.I.M.E. interests from the location of commercial ore deposits to the use of the refined or derived mineral products in everyday life.

Dow Forms Consulting Engineering Division

A CONSULTING engineering division has been established by the Dow Chemical Company with the purpose of affording its customers reasonably priced engineering services thoroughly schooled in the most efficient application of existing or future Dow products. The new division will also provide service for the development of equipment for the industrial use of Dow products.

Headquarters of the consulting engineering division are at 204 Nickels Arcade, Ann Arbor, Mich. The director of the service is Prof. W. L. Badger, of the University of Michigan.

The division is exclusively a service agency. It will not manufacture either materials or equipment. Its activities will not be confined to Dow products, but its operations will not be extended into fields where its staff, by experience and training, is not prepared to render a sound service. The division will assist in the designing of equipment and will specify equipment suitable for industrial processes within the scope of its activities.

Vegetable Oil Monopoly Inaugurated in China

CHINA'S vegetable oil monopoly which was created by decree of May 12 was formally inaugurated on August 15 at Kuling, China's summer capital, with the Minister of Industry presiding at the first board of directors' meeting, according to cable advices from Shanghai made public by the Commerce Department's Chemical Division.

Headquarters of the corporation, which is to have complete control over processing and storing of tung and other vegetable oils, will be located in Hankow. The main refining plant of the corporation will also be located in Hankow which is the shipping point for 90 per cent of tung oil exports, about 75 per cent of which is shipped directly to the United States. Eight branch refineries will be established in various oil producing districts of the country.

The decree of May 12 provides for the establishment of a semi-official corporation capitalized at approximately $740,000 to be known as the China Vegetable Oil Corporation, Ltd., which will function as agent for China's vegetable oil industry, with the view to standardizing and improving production. The corporation will also arrange financing, transporting and marketing facilities for the entire vegetable oil industry and is authorized to manufacture lubricating oils, paints, and varnishes.

Anhydrous Ammonia Used In Rubber Trade

IN a report from Trade Commissioner Harold D. Robison it is stated that anhydrous ammonia consumption in British Malaya for the prevention of coagulation of rubber latex has shown a steady increase. While import statistics do not carry a separate classification for anhydrous ammonia, it is estimated from export statistics for latex that consumption during 1934, 1935, and early 1936 was at the rate of approximately 350,000 lb. annually.

If latex for export is concentrated, it will contain about 60 per cent by weight of dry rubber; if unconcentrated, about 38 per cent. Thus to prevent the coagulation of one ton of dry rubber, in the form of concentrated latex, about 25 lb. of anhydrous ammonia are required. For one ton of dry rubber in the form of unconcentrated latex, about 38 lb. are required.

Factors in the rubber trade generally believe that the exports of latex in liquid form will continue to increase as it is more economical to ship in this manner. At present the trade has been confined to four or five concerns but many of the others are much interested in the developments.

NEWS FROM WASHINGTON

Washington News Bureau
McGraw-Hill Publishing Co.
Paul Wooton, Chief

PROCESS industry can expect better business. Every reliable index of business points that way, whether relating to manufacture, mining, merchandising, transportation, or employment. Even agricultural income is up 10 per cent over last year, despite the drought. Washington rightly interprets all this as a trend to better business, regardless of the political affiliation or economic leanings of the interpreter.

All this does not mean that Washington has forgotten politics. It has not. Every official action is judged—and criticized—on a political basis. Each one is appraised as to its vote-influencing power. This is inevitable, especially in a year of keen competition between two different philosophies of the functions of the Federal Government.

Chemical industry will be very little affected by the Walsh-Healy Law, which fixes wage and employment conditions for those who contract to sell goods or equipment to the Government. Contracts for less than $10,000 are exempt. This lets out most chemicals purchases. Still others will be exempt because "This Act shall not apply to purchase of such materials, supplies, articles, or equipment as may usually be bought in the open market." Big purchases of chemical industry products are usually so bought, cement, for example.

For a third reason this Act will not be burdensome on most chemical-process employers. Such firms pay wages and observe working standards higher than are likely to be defined under the law as minimums by the Secretary of Labor. Hence even if the law applies, it will not pinch in such cases. But, and this is important, no industrial executive can afford to contract with the Government now without having his attorneys make sure as to the implications of this Act with respect to the specific goods and specific business that is being considered.

Repeal of the tax on undistributed earnings will almost surely not come in time to affect payments by industry to Uncle Sam next year. Even if Landon becomes President and seeks repeal promptly, he is unlikely to achieve this before March 15 when the income tax returns must be made and the first quarter's payment remitted. Congress may later be willing to repeal the tax or the major vicious features of it, may even do so at Roosevelt's request. But retroactive repeal will be too much to expect when the Treasury will again be facing staggering deficits. Money so nearly "in hand" will not very readily be returned to taxpayers.

The major difference to expect next year, if Landon be elected, is a different philosophy of taxation. The punitive or disciplinary element, and the use of taxes for social reform, will not be prominent. Taxes for revenue will, however, be plenty burdensome under any coming administration.

More immediately important to business than the size of next year's tax bill are the innumerable regulations now being promulgated by the Treasury Department as a guide to industry. These demonstrate the confusion, even increasing it at times. But interpretations of interpretations continue to flow forth, will be needed for many months, perhaps even years to come.

Perhaps the most significant to chemical engineers of recent tax regulations is the series of rules formulated with respect to depreciation deductions. It is now important that all property on which such deductions are claimed be classified according to the depreciation rate applicable. Lumping together diverse types is no longer feasible. The tax assessor thus becomes almost as unpopular as the tax collector has always been.

Pricing of chemicals under the Robinson-Patman Law may prove to be much simpler than at first seemed likely. But, even so, price fixing policies will not be really simple under this anti-discrimination statute.

There is, however, no cause for panic on the part of sales executives. Straight-forward review of costs will permit the establishment of price schedules that give fair promise of standing the test of Governmental review. Furthermore, bullying police court methods and third degree sessions are not to be expected.

The Federal Trade Commission will administer the law. It regards the new regulation to be in principle, what it is in legal fact, merely an amplification of the old Section 2 of the Clayton Act. It expects to proceed against violators who permit illegal discrimination in their prices by the same procedure as has been used to administrate the old law.

When there is suspicion of an offense or when complaint has been received, there will be a private, straight-forward, business-like inquiry addressed to the company complained of or suspected. Adequate explanations to the Commission will result merely in dropping of the case without publicity. If the preliminary investigation indicates that corrections are needed, and the company is willing to make these, a mere stipulation, sort of a consent decree, will be entered; and there the matter ends. Only in the case of flagrant offenders unwilling to cooperate is it anticipated that further court procedure will be necessary.

As the first cases under this law are handled there will be established fundamental principles for the guidance of engineers in analyzing production costs and executives in fixing price schedules to correspond. Then there will be an effort to cooperate in securing compliance with the law as well as effort by legal means to enforce obedience.

Under these circumstances, Washington believes that the pricing of chemicals and the industrial products of chemical-process industry, should not be particularly difficult in the near future. It is, however, obvious that each company will review its own costs, and formulate its price policies accordingly, if it expects to escape official attention, and possible criticism. Sincere effort will, however, in most cases suffice. Managements suspected of soldiering in the hope that they will escape attention because of limited funds and staff for enforcement may be embarrassed.

Those identified with the chemical industry are being called upon frequently to point out that the American chemical industry is not profiting from the war in Spain and from the alleged building up of munitions stocks by other nations.

In reply it is pointed out that the manufacture of military explosives constitutes a very small percentage of the output of the chemical industry. It is even a small percentage of the output of the Dupont company. This latter fact especially is a surprise to many. For a period of ten years less than two per cent of the profit of that company have come from military explosives. During the last two years, officials of the Dupont company declare that less than one per cent of their profits have been derived from that part of their business. They make it clear, however, that they are not ashamed of the role they play in the munitions trade. They believe and war and navy officials believe a patriotic service is being performed in continuing that phase of their business.

Fink Addresses International Chemical Union

Special Correspondence

ELECTROCHEMISTS from all over the world gathered at Lucerne and Zurich, during the week of August 16 to 22 for the twelfth conference of the International Chemical Union. Attendance approximated 250. The various sessions, scientific meetings as well as the social functions were exceedingly well organized for which much credit is due to the committee of arrangements, in particular, to its untiring vice-president Prof. F. Fichter, of the University of Basel, Switzerland.

The five scientific and technical sessions were confined to electrochemistry and biochemistry: Prof G. Flusin of Grenoble, France, introduced the international electrochemical symposium, then followed Profs. Colin G. Fink of Columbia University, F. Giordani of the University of Naples and Jean Billiter of the University of Vienna. The biological symposium was opened by Prof. O. Warburg of Berlin. The three other biochemical addresses were presented by Prof. E. C. Dodds of London and L. Ruzicka and P. Karrer of Zurich.

Prof. G. Flusin confined himself largely to the present state of electrometallurgy in France. To illustrate the rapid growth in the development of the electric furnace he showed a series of illuminating photographs of French calcium carbide installations starting with the laboratory furnace of Moissan and concluding with modern installations employing electrodes of the Soderberg type, three and four feet in diameter. He briefly reviewed the fabrication of fused aluminum oxide, silicon, silicon carbide and silicon alloys, ferro alloys, cyanamide and phosphorus. French silico-aluminum now analyzes 65 to 70 per cent Al, 20 to 30 per cent Si, 1 per cent Fe and less than 0.5 per cent C.

Dr. Colin G. Fink presented the more recent developments in the electrochemical protection of iron and steel against corrosion. He emphasized in particular the new pinhole-free nickel coats and the acid and fire resistant chromium coats. He briefly referred to his latest discovery in the method of coating iron and steel with aluminum and concluded his survey emphasizing the rapid growth of anodic methods of protecting iron and steel. In either case, whether it be the application of cathodic coatings or an anodic treatment of the steel surface, the fundamental result is the same, namely the equi-potentialization of the steel surface thereby increasing the corrosion resistance several hundred fold.

Prof. F. Giordani of Naples discussed in detail a theoretical interpretation of the operation of the diaphragm cell for the production of alkali and chlorine. The mathematical formula he presented took into account the pore size of the diaphragm, the specific resistance of the solution, temperature, diffusion velocity, current density, and gravity factor. Calculated results of chlorine and alkali output agreed very closely with the empirical.

Dr. Jean Billiter of Vienna recounted at length the development and present status of applied electrochemistry, paying particular attention to the progress of hydrometallurgy in the United States where he recently sojourned for several months. As to the outlook for the future Prof. Billiter prophesied even greater accomplishments both in hydrometallurgy and the electric furnace art.

Otto Warburg and Walter Christian of the Kaiser Wilhelm Institut, Berlin, gave a brief account of the function of pyridine in fermentation processes. It is primarily a hydrogen carrier as numerous experiments conclusively demonstrated. It functions similarly in the production of lactic acid through fermentation.

Both processes may be regarded as based upon a pyridine catalysis, pyridine as such not participating but rather a pyridine complex, the amide of nicotinic acid, which was isolated upon treatment of the solution with acid.

Prof. E. C. Dodds of the Courtland Institute of Biochemistry discoursed on the chemical structure in relationship to hormone and biological activity referring in particular to his own researches. Prof. L. Ruzicka of the Eidgenossenschaftliche Technische Hochschule at Zurich presented the latest deductions based on his experiments and studies of the sex hormones and vitamines: The vitamines may be regarded as living plant matter, present by mere chance in the animal body, which through adaptation has become an important adjunct in the life processes. There appears to be no proof however that these vitamines must be necessarily specific in their action nor that eventually chemical compounds may not be found that may serve in their stead. One characteristic of both vitamines and hormones is most striking, namely, the minute quantities usually required for important physiological functions.

Prof. P. Karrer, Head of the School of Chemistry, University of Zurich, likewise discussed vitamines and hormones, confining himself however, to natural biochemically important pigments which have been the subject of intensive study at the Karrer laboratory: carotenoids, anthocyanins, and flavins. At least 30 carotenoids have been isolated to date; but only one flavin, lactoflavin, present in liver, eggs, kidneys, malt, etc. The so called vitamine B_2 functions like an enzyme indicating the close relationship between vitamines and ferments.

Reports of International Committees

A good deal of attention and time was devoted to various chemical topics of international interest and importance. The American delegation participated actively in the discussions. Committee on Thermochemistry of which W. Roth, is chairman and L. Keffler, secretary, reported that succinic acid has been adopted for caloricmetric determinations in the bomb. The heat of combustion of the acid at 20 deg. C. is being provisionally taken as 3025.5 cal., boiling under vacuum and constant volume. The Committee on the International Annual Tables of Constants of which F. Swarts, is chairman, and O. Scarpa, secretary, reported the resignation of Chas. Marie as editor of the Tables. The following new officers elected: N. Thon, editor in chief; P. Anger, secretary-general; R. Wurmser, treasurer. It was formally decided to continue publishing the tables, in both English and French, and that hereafter there shall be included in each volume a table of contents.

The Committee on the Reform of the Nomenclature of Inorganic Chemical Compounds, of which W. P. Jorissen, is chairman had a very lively session and many of the existing terms that have led to confused translation or interpretation were discussed. Among these are hydrosulphuric, hyposulphuric, thiosulphurous and disulphonic acids. The whole nomenclature is to be studied in detail and recommendations for simplification and standardization are to be submitted at one of the next meetings of the committee.

Byproduct Sulphuric Acid In 1935

THE output of byproduct sulphuric acid at copper and zinc plants in 1935, in terms of 60 deg. Baume acid, amounted to 603,627 short tons, of which 160,151 tons was produced at copper plants and 443,476 tons at zinc plants. The acid reported is exclusive of that made from pyrites concentrates in Montana and Tennessee. At zinc plants 23,570 tons of sulphur was used to supplement the gases derived from the roasting of the zinc blend, and 90,884 tons of sulphuric acid was produced therefrom. No sulphur was used at copper plants.

In 1934, 575,660 tons of byproduct sulphuric acid was produced. Of this amount 168,676 tons was recovered at copper plants and 406,984 tons at zinc plants. Sulphur amounting to 23,424 tons was used at zinc plants for the recovery of 89,162 tons of acid.

Symposium on Corrosion Resistant Metals

A SYMPOSIUM on Corrosion Resistant Metals in Design of Machinery and Equipment will be held as part of the American Society of Mechanical Engineers' annual meeting in New York, Nov. 30 to Dec. 4. The information presented is to be in compact form, of a practical nature, free from lengthy theoretical discussions but still sufficiently complete that when the different papers are assembled they will form a handy reference for the engineer of the subject of corrosion resistant metals.

Several of the professional divisions of the Society joined in developing the symposium making it a feature of the A.S.M.E. annual meeting where it has been allotted the whole day of Thursday, Dec. 3 with three sessions in the morning, afternoon and evening. T. H. Wickenden, past chairman of the Society's Iron and Steel Division was appointed chairman of the committee that is arranging the symposium.

The papers to be presented are as follows: Introduction to Corrosion Resisting Metals, Dr. F. N. Speller, National Tube Co., Pittsburgh, Pa.; Alloys of Aluminum, E. H. Dix, Jr., Aluminum Co. of America, New Kensington, Pa.; Nickel and Nickel-base Alloys, F. L. LaQue, The International Nickel Co., Inc., New York; Zinc in the Chemical Industries, E. A. Anderson, The New Jersey Zinc Co., Palmerton, Pa.; Lead, G. O. Hiers, National Lead Co., Brooklyn, N. Y.; Cast Iron in Chemical Equipment, Dr. H. L. Maxwell, E. I. du Pont de Nemours Co., Inc., Wilmington, Del.; Copper and Copper-base Alloys, R. A. Wilkins, Revere Copper and Brass, Inc., Rome, N. Y.; Corrosion Resistant Steel (Stainless Type), J. H. Critchett, Union Carbide and Carbon Research Laboratories, Inc., New York.

Industrial Rayon Plans New Production

A NEW company, the Rayon Machinery Corp., has been formed by the Industrial Rayon Corp. Hiram Rivitz, president of the parent company is also to head the new corporation. George P. Torrance, vice-president and general manager, will be in charge of operations. The new company was formed for the dual purpose of producing equipment for a new rayon plant which will employ a new continuous process for spinning rayon yarn, and later on to furnish similar equipment to other rayon manufacturers who may wish to use the process. The proposed new plant for Industrial Rayon will have an annual capacity of 10,000,000 lb. and will cost about $7,500,000. Initial expenditures will be met from current working capital and no new financing will be necessary for the time being, although later on stockholders may be offered rights to subscribe to additional stock.

Acetylene Association To Meet in St. Louis

THE International Acetylene Association will hold its Thirty-Seventh Annual Convention in St. Louis at the Jefferson Hotel, Nov. 18-20. This will be the first time that the convention has been held in St. Louis. Technical sessions will be held each afternoon and on two evenings. The oxy-acetylene process for welding and cutting metals will be featured at these sessions. As the result of a year of unusual developments, a series of interesting subjects will be discussed by speakers who are key men in their field. Wednesday evening, Nov. 18, is to be devoted to a forum on welding and cutting. The evening session Thursday, Nov. 19, is intended to comprise a series of popular round-table discussion on oxy-acetylene welding and cutting practices.

Award made by the Pittsburgh Section, American Chemical Society to Andrew W. Mellon—with a similar award posthumously to his brother, the late Richard B. Mellon—in recognition of the work done by the brothers in the development of the Mellon Institute of Industrial Research.

TVA Competes Actively for Industrial Business

RECENT TVA contracts with industries for power loads indicate determination to take from the utilities this class of business against which court injunctions and other legal obstacles appear unlikely.

First big industrial customer for TVA was the new Monsanto chemical plant in the Tennessee phosphate fields. This was new business, but TVA rates cut out the utilities that might have competed for it.

Latest large TVA industrial customer is the Volunteer Portland Cement Co. plant near Knoxville, Tenn. Reports are that TVA gives this plant around 35 per cent reduction over the rates of the utility that was serving it. With a load of close to 4,000 hp. the government power system thus takes a worthwhile contract from the private utility.

Rumors are that several other large industries are considering use of TVA power at the low rates offered. For its first two and a half years TVA stuck close to the letter of the TVA act in giving attention almost solely to domestic power consumers. Stymied by court actions from getting most of the major cities of the valley, TVA evidently is going after industrial load in a big way.

Lalor Foundation Will Award Fellowships

THE Lalor Foundation has announced the terms and condition of five fellowship awards of $2500 each which will be granted for the academic year 1937-38. Applications are to be in the hands of the secretary, C. Lalor Burdick, by December and appointments will be made in February, 1937.

The awards will be for research work in various fields of chemistry and related sciences. They may be used for work anywhere in the United States or abroad. However, as a memorial to the late Dr. Arthur A. Noyes, Founder of the Research Laboratory of Physical Chemistry at the Massachusetts Institute of Technology, one of the awards for each of the next four years will be specifically assigned to work at that Institution.

Appointment is open to both men and women residents of the United States. No age limit is prescribed but the usual range of ages will be between 25 and 40 years. Professors on sabbatical leave or other leave of absence are among those eligible for appointment. High intellectual and personal qualifications as well as creative ability and capacity for productive scholarship are essential elements in the appraisal of candidates.

PERSONALITIES

WALTER L. BADGER, professor of chemical engineering, University of Michigan, has been appointed director of the Dow Chemical Co.'s new consulting engineering division at Ann Arbor, Mich. Professor Badger plans to continue teaching at Michigan on a half-time basis. He will be in charge of certain graduate courses in chemical engineering.

ALFRED CLARK, Ph. D., Univ. of Illinois, 1935; John E. Dorn, Ph. D. Univ. of Minnesota, 1936; Robert P. Graham, M.S., Univ. of Washington, 1936; and L. G. Turnbull, Ph. D., Univ. of Toronto, 1936, have been appointed research associates at Battelle Memorial Institute for 1936-1937.

JOHN GAMBLE KIRKWOOD of Cornell University was the recipient of the American Chemical Society Award in Pure Chemistry, presented at the society's ninety-second meeting at Pittsburgh, Pa., on September 9.

CALENDAR

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Niagara Falls Power and Process Meeting, in cooperation with the World Power Conference, Niagara Falls, N. Y., September 16-20.

ELECTROCHEMICAL SOCIETY, semi-annual meeting, Niagara Falls, N. Y., October 8-10.

SOUTHERN CHEMURGIC CONFERENCE, Lafayette, La., Oct. 15.

NATIONAL METAL CONGRESS AND EXPOSITION, Cleveland, Oct. 19-23.

AMERICAN PETROLEUM INSTITUTE, annual meeting, Chicago, Ill., November, 9-12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, annual meeting, Baltimore, Md., November 11-13.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS, annual meeting, Providence, R. I., December 4-5.

INTERNATIONAL BUREAU FOR TECHNICAL EDUCATION, Rome, Italy, Dec. 28-30.

TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY, annual meeting, February 15-18, 1937.

AMERICAN CHEMICAL SOCIETY, semi-annual meeting, Chapel Hill, N. C., April 12-15, 1937.

SIDNEY D. KIRKPATRICK, editor of Chemical & Metallurgical Engineering, has been elected to the board of directors of the McGraw-Hill Book Co. He is consulting editor of its chemical engineering series of texts and reference books.

RALPH EMMONS HALL, head of Hall Laboratories, Inc., Pittsburgh, has received the honorary degree of Doctor of Science from Ohio Wesleyan University.

MATHEW M. BRAIDECH, senior chemist of the Baldwin Filtration Plant, Cleveland, Ohio, has been awarded the John M. Goodell prize given annually by the American Water Works Association.

H. E. JORDAN, chemical engineer for the Indianapolis Water Co., Indianapolis, is the recipient of the American Water Works Association's John M. Diven Memorial Medal.

ROBERT B. THOMPSON, formerly an assistant in sanitary engineering at Harvard University, has joined the Dorr Co. at Westport, Conn. as junior sanitary engineer. Mr. Thompson graduated from the Massachusetts Institute of Technology in 1932.

CHESTER H. JONES has been appointed sales director of the Specialties Division of the Cochrane Corp. of Philadelphia. His new activities will be concerned with the more economical utilization of process steam in the food, textile and chemical engineering fields. "Doc" Jones is a former Western manager and industrial editor of *Chem. & Met.*

ROBERT R. WARNER, a graduate of the department of chemical engineering of the University of Michigan, is now employed by E. I. duPont de Nemours & Co., Ammonia Dept., Wilmington, Del.

ROGER G. BROWN has joined the Dorr Co. as chemical engineer. He is a graduate of the Georgia School of Technology.

FREDERICK W. ADAMS, Charles M. Cooper and Robert L. Hersey, former directors respectively of the Boston,

Walter L. Badger

Bangor and Buffalo Field Stations of the School of Chemical Engineering, Massachusetts Institute of Technology, have recently accepted positions in the industrial field. Professor Adams has been appointed senior incumbent in a multiple fellowship established by the Pittsburgh Plate Glass Co. at the Mellon Institute. Professors Cooper and Hersey have joined the staff of E. I. duPont de Nemours & Co., Inc.

J. W. KELLOGG has joined the Iodine Educational Bureau, Inc., New York City, as director of animal husbandry. For many years, Dr. Kellogg has been in charge of laboratory work on fertilizer and feed inspection for the State of Pennsylvania.

R. P. RUSSELL, vice-president and general manager of the Standard Oil Development Co., has been named to head the newly created technical division of the company. The commercial division will be headed by H. W. Fisher, former assistant director of the Esso Laboratories.

J. C. WARNER, associate professor of theoretical chemistry at the Carnegie Institute of Technology, has been appointed associate professor of metallurgy at that school.

HORACE N. LEE, formerly of the Harvard University research staff, has joined Arthur D. Little, Inc., Cambridge, Mass., as a fiber specialist and industrial microscopist.

GROVER C. DILLMAN is the new president of the Michigan College of Mining and Technology at Houghton.

O. H. WOOLFORD, formerly manager of the Flow Meter Division of the Cochrane Corp., Philadelphia, has been named head of the general sales department of the company.

A. R. ELLIS has been made president of the Pittsburgh Testing Laboratory, Pittsburgh, Pa.

GLEN J. CHRISTNER, formerly in charge of the New York insulation division of the Eagle-Picher Lead Co., has been transferred to Cincinnati as manager of the insulation division of the entire company.

L. R. SMITH has been elected to the office of chairman of the board of the A. O. Smith Corp. of Milwaukee. W. C. Heath has been elected president, and J. M. Floyd, vice-president in charge of manufacture and engineering.

ROLAND M. WATERS and ROBERT B. WATERS, recent graduates of the chemical engineering department of the University of Michigan, are now employed respectively by the Anderson Prichard Oil Corp. and the Frederick A. Stresen-Reuter Corp., both at Chicago.

J. HENRY RUSHTON has been appointed assistant professor of chemical engineering at the University of Michigan to replace Professor W. L. McCabe, who has gone to the Carnegie Institute of Technology. Dr. Rushton received his scholastic training at the University of Pennsylvania.

W. H. PENSOLA, formerly with the Vita-Var Corporation, Newark, N. J., is in charge of the new research laboratory opened recently by the Imperial Oil & Gas Products Co., Pittsburgh, Pa.

CLARENCE A. SIEBERT has been added to the department of chemical engineering staff at the University of Michigan as assistant professor. Dr. Siebert has for the past two years been an instructor in chemical engineering at Wayne University, Detroit.

DONALD L. KATZ is another new assistant professor of chemical engineering at the University of Michigan. Dr. Katz was formerly in the research department of the Phillips Petroleum Co. at Bartlesville, Oklahoma.

THOMAS MIDGELY, JR. of the Ethyl Gasoline Corp. will be the recipient of the Perkin Medal for 1937. The medal is awarded annually by the Society of Chemical Industry in recognition of valuable work in applied chemistry. It will be presented to Dr. Midgely at the joint meeting of the Society of Chemical Industry and the American Chemical Society to be held in New York on January 8, 1937.

WALTER S. LANDIS of the American Cyanamid Co. has been elected to receive the Chemical Industry Medal for 1936. The award is made annually to a person making a valuable application of chemical research to industry.

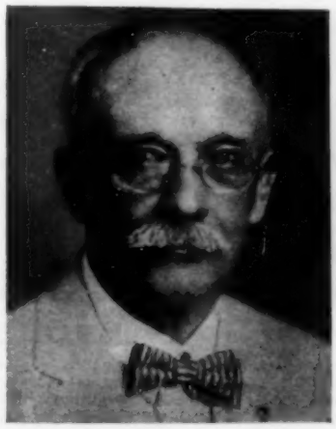
W. J. SWEENEY, formerly director of the Development Department of the Standard Oil Co. of Louisiana at Baton Rouge, has been made associate director of the Esso Laboratories at Bayway, N. J.

HENRY SPENCER, graduate in chemical engineering from Iowa State College is employed by the Calco Chemical Co. at Bound Brook, N. J.

W. T. WEBSTER has been appointed superintendent of the St. Regis Kraft Co. of Tacoma, Wash. Mr. Webster was formerly an engineer with the J. O. Ross Engineering Corp., New Brunswick, N. J.

C. A. ANDERSON, formerly with the Gilman Paper Co., Gilman, Vt., is now employed by the U. S. Gypsum Co. at Oakmont, Pa.

Edward Weston



OBITUARY

EDWARD WESTON, noted inventor in the fields of electricity and electrochemistry, died August 20 at Montclair, N. J.

Born in England in 1850, Dr. Weston came to America twenty years later and became interested in nickel plating. He so improved the process used at that time that today he is credited with much of the fundamental development of this large industry. He later turned to the field of electricity where he has gained world wide recognition through his work on electrical measuring instruments and dynamos and the invention of the standard cell. He was an endower of Stevens Institute and has donated funds to the American Electro-chemical Society for the establishment of a research fellowship in electro-chemistry.

WILLIAM RINTOUL, eminent British chemist and well known in this country, died at Ayrshire, England, on August 25. For ten years he was manager of the vast research organization of Imperial Chemical Industries, Ltd. at Billingham. Members of the A.I.Ch.E. who in 1928 visited Nobels at Ardeer will remember Dr. Rintoul as the chief chemist there.

CHARLES J. HOODLESS, for 24 years general superintendent of the Pennsylvania Sugar Co., Philadelphia, died of heart failure on August 29. Mr. Hoodless received his early training in the beet sugar industry in Michigan.

JOHN H. LUENING, gas engineer, died on August 20 at Louisville, Ky., where he was head of the consulting firm bearing his name. Mr. Luening was a past secretary and treasurer of the Compressed Gas Manufacturers' Association and was formerly chief engineer of the Kentucky Oxygen and Hydrogen Co., and later the Helium Co.

EDWARD M. GILES, chemical engineer, died on August 14. For the past eight years, Mr. Giles has been associated with C. E. Hoover, New York color manufacturer.

CARL HAMBUECHEN died recently in St. Louis. He was treasurer of the Benwood-Linze Co. of that city.

AUBREY C. GRUBB, professor of physical chemistry at the University of Saskatchewan since 1921, died in Saskatchewan, Sask., recently. Dr. Grubb had been ill several years and retired from class work in February. His work related to electrical activation of hydrogen and nitrogen gases.

Company Formed Abroad To Produce Sulphur

A NEW company, Sulphur Patents Limited, is being formed by Imperial Chemical Industries Limited, England, and Bolidens Gruvaktiebolag, Sweden, for the joint exploitation of the processes developed by the two companies for the manufacture of sulphur and liquid sulphur dioxide from the sulphurous gases evolved in metallurgical operations such as the roasting and smelting of sulphide ores.

The processes of the two companies are essentially different, but together cover such a wide field of application that it is claimed there are very few problems, connected with the disposal of sulphurous gases, which cannot be solved technically in a satisfactory manner by one or other of the processes.

The processes controlled by Sulphur Patents Limited also offer a means for the production of elemental sulphur or liquid sulphur dioxide from pyrites or similar materials.

By their use the nuisance arising through the discharge to atmosphere of gases containing appreciable concentrations of sulphur dioxide can be reduced or, if desired, entirely eliminated. Under average conditions this elimination of a nuisance is achieved with the production of sulphur, or liquid sulphur dioxide at a cost which shows a reasonable return on the capital expenditure required for the erection of the plant.

There are two main processes controlled by Sulphur Patents Limited viz.: (1) The process developed by Bolidens G. B. for the direct recovery of sulphur from raw gas, and used by them in their smelter at Rönnskär, Sweden, where 20—25,000 tons of high quality sulphur are produced annually. (2) The I. C. I. processes of sulphur dioxide concentration followed by liquefaction of the sulphur dioxide or reduction to elemental sulphur. The concentration process is used by the Outokumpu Oy, in their copper smelter at Imatra, Finland, where a plant having a designed capacity of 52 tons per day of liquid sulphur dioxide was put into operation during the Spring of 1936.

Progress Made by Canada's Salt Cake Industry

THE sodium sulphate industry of Canada now employs 200 persons throughout the year, is capable of producing 600 tons of dried salt daily, and contributes close to $750,000 annually in freight revenues to the Canadian National Railway, according to reports from the commercial attache at Ottawa.

Since 1921, when engineers from the Federal Department of Mines surveyed areas in Saskatchewan where they found sodium sulphate deposits estimated at more than 120 million tons, the industry has produced approximately 300,000 tons of salt cake valued at about $2,500,000, the report states.

A total of 44,800 tons of salt cake, valued at $343,000, was produced in 1935 compared with 66,800 tons, valued at $588,000, in 1934. The decline in 1935 was attributed to several causes, chief among which was the large excess of production over requirements in 1934. During the current year with the demand increasing and with producers making every effort to improve the quality of their products, a substantial gain in output is anticipated.

A large portion of the Canadian output is shipped to Copper Cliff, Ontario, where it is converted into niter cake for use in the metallurgical treatment of nickel-copper matte.

Dupont Releases Motion Picture on Chemicals

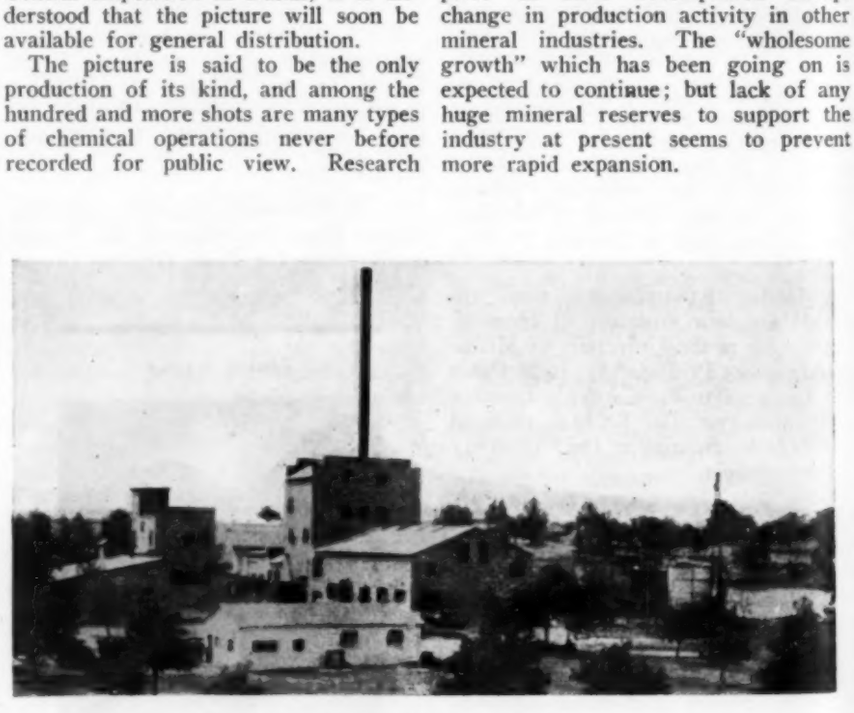
LAST month the E. I. du Pont de Nemours & Co. announced that it had released for public showing an educational sound motion picture entitled "The Wonder World of Chemistry." Although the present showings will be confined to Wilmington and to the company's exhibit at the Texas Centennial Central Exposition in Dallas, it is understood that the picture will soon be available for general distribution.

The picture is said to be the only production of its kind, and among the hundred and more shots are many types of chemical operations never before recorded for public view. Research chemists and operators are shown engaged in their daily work. Included in the picture are such operations as the fixation of nitrogen from the air; the synthesis of a rubber-like substance from coal, limestone, and salt; the derivation of dyes and perfume materials from coal tar; the transformation of natural cellulose from cotton and wood into rayon and transparent cellulose film; the making of plastics, coated fabrics, and finishes from cotton and vegetable oils.

Westvaco Will Take up Beryllium Production

THE forecast of the Bureau of Mines that beryllium production would be increased by entry of a third important factor into the industry has occasioned questioning in Washington. The two former producers were Beryllium Products Corp., now operating at Temple, Pa., and Brush Beryllium Co., of Cleveland, Ohio. The large chemical company "expected to engage in the production of beryllium in 1936" is Westvaco Chlorine Products Co.

Apparently the Bureau comments have been over-interpreted by some readers. Bureau officials explain that they did not intend to imply any change in the order of magnitude of beryllium production, nor any such large cuts in price as have accompanied abrupt change in production activity in other mineral industries. The "wholesome growth" which has been going on is expected to continue; but lack of any huge mineral reserves to support the industry at present seems to prevent more rapid expansion.



New Plant of Michigan Chemical Corp.

Michigan Chemical Corp., Saint Louis, Mich., has placed its new $200,000 plant in operation for the production of sodium chloride, liquid bromine, bromides, and other related chemical products. Officers are Walter B. Wilkinson, president and treasurer; John L. Giles, vice-president and general manager; Donald H. Wilkinson, vice-president and secretary; Robert L. Wilson, assistant secretary and assistant treasurer.

Chemical ECONOMICS

AT THE close of last month the Department of Commerce made public a report showing that sales of goods both by manufacturers and wholesalers registered substantial gains in July, compared with July, 1935, as well as June of this year. The report, based on a survey made jointly by the Bureau of Foreign and Domestic Commerce and the National Association of Credit Men, said that total net sales of 568 manufacturers throughout the country showed an increase of about 33 per cent in July over July, 1935.

All the fifteen industries included in the survey had increases ranging from 9.7 per cent for leather and its products to 72 per cent for iron and steel and their products, while stone, clay and glass products and motor vehicle parts each exceeded 50 per cent. Without adjustment for seasonal influence, July sales registered an increase of over 9 per cent from those of the preceding month.

The Federal Reserve unadjusted index for industrial production for July was placed at 104 which coincides with that for the preceding month. The adjusted index for manufactures for July was 109 which compares with 104 for June. The decline in August—for which indexes are not yet available—was due in large part to the drop in automotive production.

A new high for shipments of non-acetate rayon yarn during July resulted in a further reduction of surplus stocks in the hands of producers to the lowest level in six years, according to *Rayon Organon*.

The available supply of unsold popular yarns went uncomfortably close to zero and many producers find themselves oversold.

Production for the first six months of 1936 was at a record, totaling 105,200,000 lb. or 6 per cent greater than the 99,100,000 lb. in the first half of 1935. While production increased 6 per cent during the half-year, shipments to mills gained 20 per cent thus preventing the normal summer stock build-up for fall business.

Production of superphosphate in July was much the largest for the month in several years, exceeding July of last year by 20 per cent, according to reports by acidulators to The National Fertilizer Association. Aggregate output was 200,326 tons, representing a seasonal rise over June which is usually the low month of the year. Beginning with July the seasonal trend is upward through December. The increase in July production over last year was particularly large in the southern area. For the first seven months of the year an 8 per cent increase was registered over the same period of 1935, with a 9 per cent rise reported by Northern acidulators against a 7 per cent increase in the South.

Shipments to consumers were unusually small in July, but other classes of shipments were larger than usual for the month. July shipments are relatively unimportant, accounting in the past for only 2 per cent of the total year's shipments to consumers and less than 5 per cent of the annual shipments to mixers. When comparison is made for the first seven months of the year it will be noted that there have been substantial increases over 1935, with shipments to mixers 35 per cent larger, shipments to consumers 25 per cent larger and shipments in base and mixed goods 7 per cent larger.

Production of synthetic methanol is on the way to a new record this year. Starting with an output of 1,418,863 gal. in January, every month since then has registered an increase over the preceding month until a production of 1,950,825 gal. was reached in July. Production for the first seven months this year was 11,853,015 gal. with the twelve-month production last year, 18,046,929 gal. Production reached its high last year in October with an output of 2,508,978 gal. and November followed closely with 2,373,475 gal.

Continuing the steady progress that has been maintained in recent years, United States exports of chemicals and related products advanced 20 per cent during the first half of 1936 with notable gains being recorded in foreign shipments of benzol, dyes, sulphur, fertilizers, and a number of other products. Exports of such products were valued at $75,733,000 during the six month period compared with $62,670,000 in the first half of 1935 and $45,909,000 for the corresponding months of 1933, preliminary statistics show.

Foreign demand for all types of American fertilzers has been especially heavy since the beginning of the year. Shipments to foreign countries during the first half of the year aggregated 858,000 tons, valued at $9,801,000, against exports of 560,356 tons, valued at $5,100,000 during the corresponding months of 1935. Phosphate shipments increased from 452,575 to 649,600 tons; potashes from 33,085 to 47,891; and nitrogenous materials from 55,643 to 146,585 tons, preliminary statistics show.

Export demand for sulphur since the beginning of 1936 has been the best in years, statistics reveal. Shipments of this product, both crude and refined totalled 295,000 tons, valued at $5,506,000, compared with 182,734 tons, valued at $3,607,000, in the first half of last year.

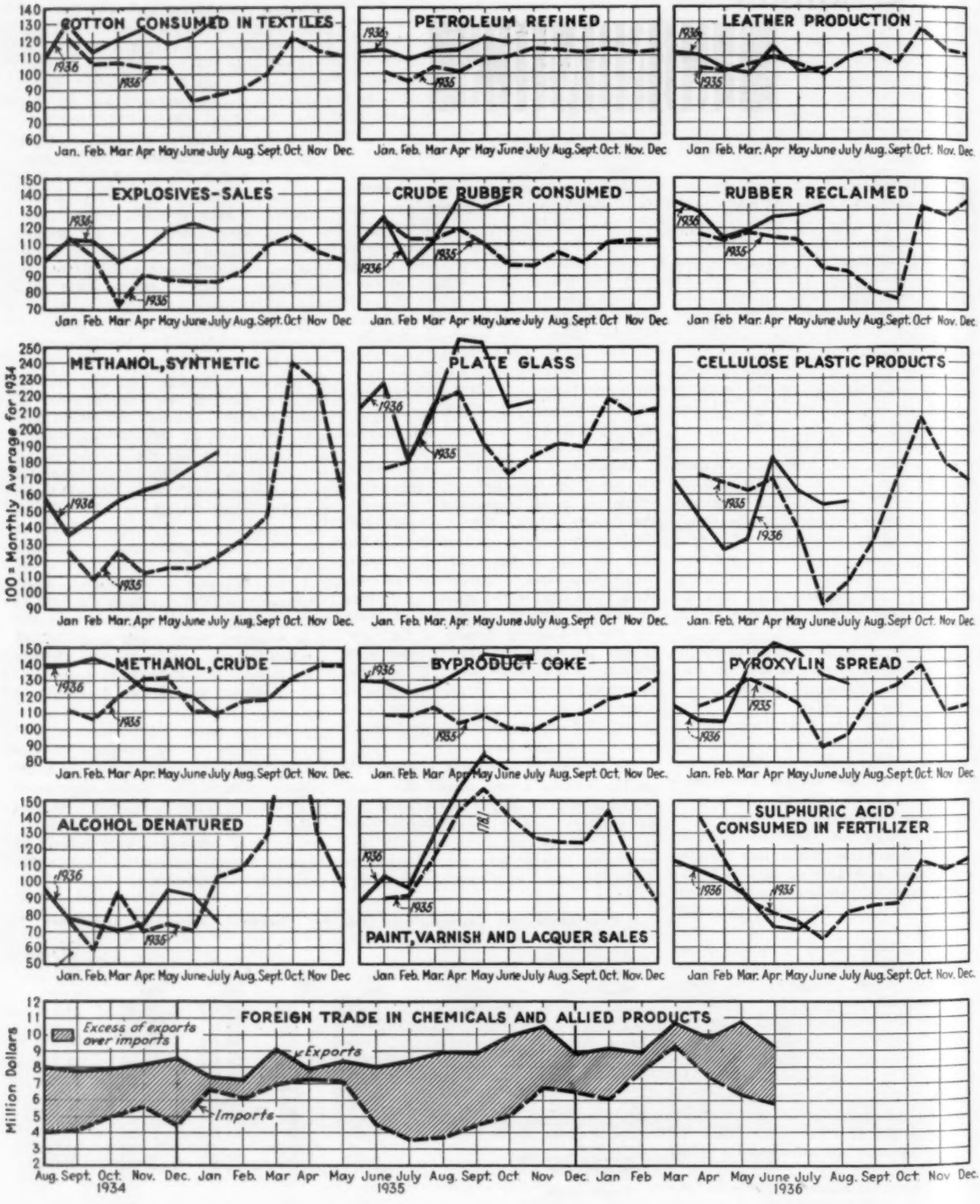
American paint products were sold to practically every country of the world during the first half of the year. Shipments during the period aggregated $8,790,000 in value compared with $7,860,800 in the first half of last year—the increase being due very largely to heavier demand for ready mixed paints, varnishes and lacquers.

Production and Consumption Data for Chemical Consuming Industries

	July 1936	July 1935	Jan.-July 1936	Jan.-July 1935	Gain Jan.-July 1936 over Jan.-July 1935 Per cent
Production					
Alcohol denatured, 1000 wi. gal	6,067	8,192	44,675	43,307	3.2
Ammonia, tons†	59,761	40,123	386,828	293,664	31.7
Automobiles, No.	440,999	332,109	2,929,875	2,550,364	14.8
Benzol, 1000 gal.	8,818	6,062	58,708	42,529	38.0
Byproduct coke, 1000 tons	3,718	2,566	24,340	19,123	27.2
Cellulose acetate plastics, 1000 lb.	1,002	486	6,516	5,515	18.1
Nitrocellulose plastics, 1000 lb.	1,225	1,026	8,887	8,941	0.06*
Glass containers, 1000 gr.	3,844	3,576	24,656	21,882	12.7
Plate glass, 1000 sq. ft.	16,428	13,909	118,509	101,273	17.1
Methanol, crude, gal.	374,110	379,309	3,106,153	2,829,628	9.1
Methanol, synthetic, gal.	1,950,825	1,278,505	11,853,015	8,580,316	38.1
Pyroxylin spread, 1000 lb.	4,686	3,587	33,652	29,228	15.1
Rosin, wood, bbl.	55,151	47,651	371,593	319,884	16.2
Turpentine, wood, bbl.	8,523	7,261	60,276	48,177	25.1
Steel barrels, No.	761,517	560,311	4,598,812	3,596,515	27.9
Consumption					
Cotton, 1000 bales	603	391	3,924	3,226	21.6
Silk, bales	36,658	44,166	241,794	289,534	16.5*
Explosives, sales, 1000 lb.	30,484	22,189	202,663	163,953	23.6

* Per cent of decline. † Sulphate equivalent of byproduct coke plant production.

TRENDS OF PRODUCTION AND CONSUMPTION



The MARKETS

A MODERATE slowing up in demand for chemicals was reported for August with the hot-weather period in general losing most of its seasonal influence. Consumption of chemicals for the two months—July and August—dropped but little below that for the preceding months. With the turn of the month a good call has been experienced for deliveries against existing contracts and expectations are high for an expanding consuming demand throughout the next three months.

Prices for chemicals were steady for the most part with fluctuations in both directions for some of the less important products. Most important from a price viewpoint was the fact that benzol sold throughout the last month at a reduced figure; that nitrate of soda for October forward delivery was held at an advanced price; and that alcohol producers were willing to accept business for delivery through next March. In the metal list, platinum was advanced sharply. Prices for zinc oxide will be advanced one-quarter cent per pound on Oct. 1.

With excise taxes now in effect, prices for vegetable oils were higher although linseed and China wood oils ran counter to the general trend. Tallow also was higher in price with curtailment of domestic production expected and imports at a disadvantage of an import duty of one-half cent a pound together with an excise tax of 3 cents a pound.

In the naval stores industry the principal development rests in the movement to cut down production so as to stabilize the market. A report from Washington says that a total of 921 operators in seven Southeastern States are participating in the program. They have agreed to take out of production 14,286,678 faces from the total of 78,627,209 faces they operated prior to July 1. It is estimated that the total number of faces operated by all producers was about 125,000,000.

Benefit payments will be made late in the fall, after the close of the season, and following an inspection by Department of Agriculture representatives.

The decline in sales prices for linseed oil during the month may be attributed to the more favorable news which came from the Argentine. The Ministry of Agriculture issued a crop estimate in which the linseed area this season was placed at 2,950,000 hectares. With an acreage larger than that of last year and with growing conditions so far favorable, it is probable that Argentine seed exportable from the present crop will greatly exceed that of last year. This is proving more than an offset to the very small seed crop now being produced in the American Northwest.

Trading in cane blackstrap molasses futures on the New York Coffee and Sugar Exchange after more than four years of inactivity was revived on Aug. 27, revival being based on the prospect of increased use of the commodity because of higher feedstuff prices induced by the drouth.

Among foreign developments as reported to the Department of Commerce is the statement that Russia's naval stores industry, now celebrating its tenth anniversary, has grown rapidly in recent years and according to Soviet claims now stands third among world producers, the output being exceeded only by that of the United States and France. The industry which is said to employ approximately 70,000 workers is reported to have produced 80,000 tons of crude gum in 1935 and the current year's program calls for an output of 100,000 tons. The country is reported to be entirely self-sufficient insofar as its turpentine and rosin requirements are concerned.

A new cellulose enamel known as "Emailliola" recently developed in Germany is claimed to be insoluble in water, benzine, benzol, turpentine, or acetone, and is said to be highly resistant to acids and alkalies and to weather and mechanical influences, according to reports from Berlin.

A Czechoslovakian decree which became effective on August 1 placed the importation of carbon black under government control, a report from Prague states. The measure is designed to provide protection for the new domestic industry. Imports of carbon black into that country during the first half of 1936 aggregated 610 metric tons, about two-thirds of which came from the United States.

A new Nicaraguan law permits artificial fertilizers for use on banana plantations to be imported free of duties and all other forms of taxation, according to reports from Managua. As banana growers in that country have heretofore considered the use of artificial fertilizers uneconomic this legislation may indicate the opening of a new fertilizer market.

Several developments in the Japanese caustic soda markets are reported which have direct bearing on the international trade in the product. Among the more interesting of these developments is the increased production figures in Japan. Those figures show an increase from 32,864 metric tons in 1930 to 213,319 in 1935. The export figures also are of interest, showing, as they do, exports of 3,178 tons in 1931 (first year reported) to 17,496 tons in 1935.

Japan's carbide Union, long in the forming, and which is intended to give Nippon chemists control over the carbide industry at home, has been completed, according to advices reaching government officials in Washington.

The Union is to limit carbide production beginning Sept. 1, to 80,000 metric tons per annum. This figure represents the amount of carbides produced for the open market only, and the total of production of calcium carbide is, of course, appreciably larger.

CHEM. & MET. Weighted Index of CHEMICAL PRICES

Base = 100 for 1927

This month	**86.34**
Last month	86.36
September, 1935	87.35
September, 1934	87.51

Prompt shipment nitrate of soda is unchanged in price but forward deliveries are higher. A slight drop in the index number was largely due to lower prices for benzol throughout the month. In general prices were steady with a firm undertone.

CHEM. & MET. Weighted Index of Prices for OILS AND FATS

Base = 100 for 1927

This month	**91.30**
Last month	90.92
September, 1935	87.98
September, 1934	68.65

Price changes were numerous with declines for some of the vegetable oils, notably linseed and China wood. Animal fats were very strong and advanced rather sharply in price. Glycerine stocks are low with prices very firm.

Current PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to September 10.

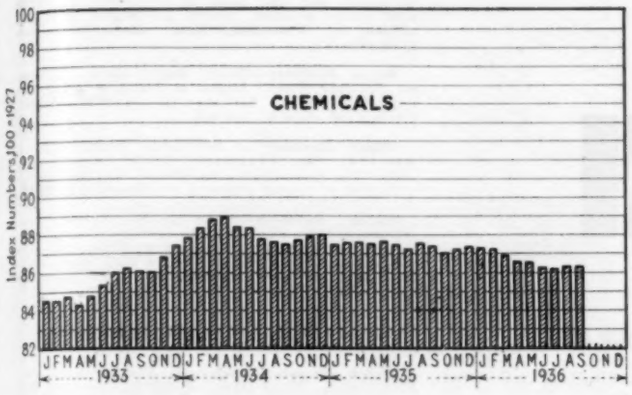
Industrial Chemicals

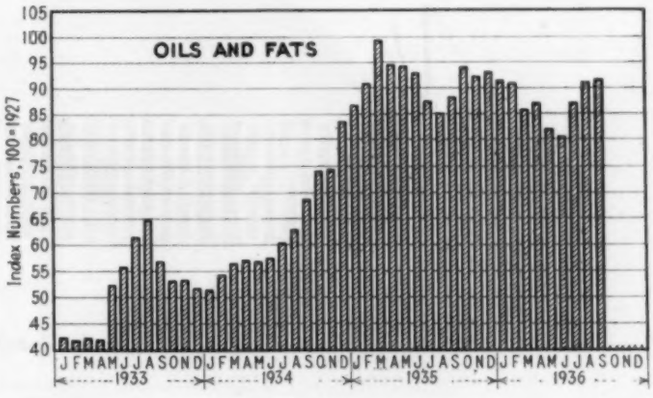
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.08 –$0.09	$0.08½–$0.10	$0.12–$0.12½
Acid, acetic, 28%, bbl., cwt.	2.45 – 2.70	2.45 – 2.70	2.45 – 2.70
Glacial 99%, drums	8.43 – 8.68	8.43 – 8.68	8.43 – 8.68
U. S. P. reagent	10.52 –10.77	10.52 –10.77	10.52 –10.77
Boric, bbl., ton	105.00–115.00	105.00–115.00	105.00–115.00
Citric, kegs, lb	.26 – .29	.26 – .29	.28 – .31
Formic, bbl., ton	.11 – .11½	.11 – .11½	.11 – .11½
Gallic, tech., bbl., lb	.60 – .65	.60 – .65	.60 – .65
Hydrofluoric 30% carb., lb	.07 – .07½	.07 – .07½	.07 – .07½
Lactic, 44%, tech., light, bbl., lb.	.11½– .12	.11½– .12	.12 – .12½
Muriatic, 18°, tanks, cwt.	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –	18.50 –20.00
Oxalic, crystals, bbl., lb.	.11½– .12½	.11½– .12½	.11½– .12½
Phosphoric, tech., c'bys., lb.	.09 – .10	.09 – .10	.09 – .10
Sulphuric, 60°, tanks, ton	11.00 –11.50	11.00 –11.50	11.00 –11.50
Sulphuric, 66°, tanks, ton	15.50 –	15.50 –	15.50 –
Tannic, tech., bbl., lb.	.20 – .30	.23 – .35	.23 – .35
Tartaric, powd., bbl., lb.	.24 – .25	.24 – .25	.24 – .25
Tungstic, bbl., lb.	1.50 – 1.60	1.50 – 1.60	1.50 – 1.60
Alcohol, Amyl	–	–	–
From Pentane, tanks, lb.	14.3 –	14.3 –	.15 –
Alcohol, Butyl, tanks, lb.	.08½–	.08½–	.13 –
Alcohol, Ethyl, 190 p'f., bbl., gal.	4.14 –	4.27½–	4.27½–
Denatured, 190 proof			
No. 1 special, dr., gal wks.	.29 –	.33 –	.34 –
Alum, ammonia, lump, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Chrome, bbl., lb.	.04½– .05	.04½– .05	.04½– .05
Potash, lump, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Aluminum sulphate, com, bags cwt.	1.35 – 1.50	1.35 – 1.50	1.35 – 1.50
Iron free, bg., cwt.	2.00 – 2.25	2.00 – 2.25	1.90 – 2.00
Aqua ammonia, 26°, drums, lb.	.02½– .03	.02½– .03	.02½– .03
tanks, lb.	.02½– .02½	.02½– .02½	.02½– .02½
Ammonia, anhydrous, cyl., lb.	.15½– .16	.15½– .16	.15½– .16
tanks, lb.	.04½–	.04½–	.04½–
Ammonium carbonate, powd. tech., casks, lb.	.08 – .12	.08 – .12	.08 – .12
Sulphate, wks., cwt.	1.25 –	1.25 –	1.20 –
Amylacetate tech., tanks, lb.	.12 – .135	.12 – .135	.142–
Antimony Oxide, bbl., lb.	.12½– .13½	.12½– .13½	.11½– .12½
Arsenic, white, powd., bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Red, powd., kegs, lb.	.15½– .16	.15½– .16	.15½– .16
Barium carbonate, bbl., ton	56.50 –58.00	56.50 –58.00	56.50 –58.00
Chloride, bbl., ton	72.00 –74.00	72.00 –74.00	72.00 –74.00
Nitrate, cask, lb.	.08½– .09	.08½– .09	.08½– .09
Blanc fixe, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 – 2.10	2.00 – 2.10	1.90 – 2.00
Borax, gran., bags, ton	44.00 –49.00	44.00 –49.00	44.00 –49.00
Bromine, cs., lb.	.36 – .38	.36 – .38	.36 – .38
Calcium acetate, bags	2.10 –	2.10 –	2.10 –
Arsenate, dr., lb.	.06 – .07	.06 – .07	.06 – .07
Carbide drums, lb.	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., del., ton	20.00 –33.00	20.00 –33.00	20.00 –33.00
flake, dr., del., ton	22.00 –35.00	22.00 –35.00	22.00 –35.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb.	.05½– .06	.05½– .06	.05½– .06
Tetrachlorides drums, lb.	.05½– .08½	.05½– .06	.05½– .06
Chlorine, liquid, tanks, wks., lb.	2.15 –	2.15 –	2.00 –
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.41 – 1.51	1.41 – 1.51	1.39 – 1.45
Copperas, bgs., f.o.b., wks., ton	15.00 –16.00	15.00 –16.00	14.00 –15.00
Copper carbonate, bbl., lb.	.08½– .16	.08½– .16	.08½– .16
Sulphate, bbl., cwt.	4.00 – 4.25	4.00 – 4.25	3.85 – 4.00
Cream of tartar, bbl., lb.	.16½– .17	.16½– .17	.16½– .17
Diethylene glycol, dr., lb.	.16½– .20½	.16½– .20½	.16½– .20½
Epsom salt, dom., tech., bbl., cwt.	1.80 – 2.00	1.80 – 2.00	2.10 – 2.15
Ethyl acetate, drums, lb.	.07 –	.07 –	.08½–
Formaldehyde, 40%, bbl., lb.	.06 – .07	.06 – .07	.06 – .07
Furfural, dr., lb.	.10 – .17½	.10 – .17½	.10 – .17½
Fusel oil, ref. drums, lb.	.16 – .18	.16 – .18	.16 – .18
Glaubers salt, bags, cwt.	.85 – 1.00	.85 – 1.00	1.00 – 1.10
Glycerine, c.p., drums, extra, lb.	.19½–	.15½–	.14 – .14½
Lead:			
White, basic carbonate, dry casks, lb.	.06½–	.06½–	.06½–
White, basic sulphate, sck., lb.	.06 –	.06 –	.06 –
Red, dry, sck., lb.	.07 –	.07 –	.06½–
Lead acetate, white crys., bbl., lb.	.10½– .11	.10½– .11	.10½– .11
Lead arsenate, powd., bbl., lb.	.09 – .10	.09 – .10	.09 – .10
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, pwd., csk., lb.	.06 –	.06 –	.05½–
Lithophone, bags, lb.	.04½– .05	.04½– .05	.04½– .05
Magnesium carb., tech., bags, lb.	.06 – .06½	.06 – .06½	.06 – .06½
Methanol, 95%, tanks, gal.	.33 –	.33 –	.33 –
97%, tanks, gal.	.34 –	.34 –	.34 –
Synthetic, tanks, gal.	.35½–	.35½–	.35½–
Nickel salt, double, bbl., lb.	.13 – .13½	.13 – .13½	.12½– .13
Orange mineral, csk., lb.	.10 –	.10 –	.09½–
Phosphorus, red, cases, lb.	.44 – .45	.44 – .45	.44 – .45
Yellow, cases, lb.	.28 – .32	.28 – .32	.28 – .32
Potassium bichromate, casks, lb.	.08½– .09	.08½– .09	.07½– .08½
Carbonate, 80–85%, calc. csk., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Chlorate, powd., lb.	.08 – .08½	.08 – .08½	.08½– .09
Hydroxide (c'stic potash) dr., lb.	.06½– .06½	.06½– .06½	.06½– .06½
Muriate, 80% bgs., ton	23.00 –	23.00 –	22.00 –
Nitrate, bbl., lb.	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.18½– .19	.18½– .19	.18½– .19
Prussiate, yellow, casks, lb.	.18 – .19	.18 – .19	.18 – .19
Sal ammoniac, white, casks, lb.	.04½– .05	.04½– .05	.04½– .05
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	13.00 –15.00	13.00 –15.00	13.00 –15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 –	1.23 –	1.23 –
Dense, bags, cwt.	1.25 –	1.25 –	1.25 –
Soda, caustic, 76%, solid, drums, contract, cwt.	2.60 – 3.00	2.60 – 3.00	2.60 – 3.00
Acetate, works, bbl., lb.	.04½– .05	.04½– .05	.04½– .05
Bicarbonate, bbl., cwt.	1.85 – 2.00	1.85 – 2.00	1.85 – 2.00
Bichromate, casks, lb.	.06½– .07	.06½– .07	.05½– .06½
Bisulphate, bulk, ton	15.00 –16.00	15.00 –16.00	15.00 –16.00
Bisulphite, bbl., lb.	.03½– .04	.03½– .04	.03 – .04
Chlorate, kegs, lb.	.06½– .06½	.06½– .06½	.06½– .06½
Chloride, tech., ton	12.00 –14.75	12.00 –14.75	12.00 –14.75
Cyanide, cases, dom., lb.	.15½– .16	.15½– .16	.15½– .16
Fluoride, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.75 – 3.00	2.90 – 3.00	3.25 – 3.40
Nitrate, bags, cwt.	1.29 –	1.29 –	1.275–
Nitrite, casks, lb.	.07½– .08	.07½– .08	.07½– .08
Phosphate, dibasic, bbl., lb.	.022– .023	.022– .023	.022– .024
Prussiate, yel. drums, lb.	.11½– .12	.11½– .12	.11½– .12
Silicate (40° dr.) wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr., lb.	.02½– .03½	.02½– .03	.02½– .03
Sulphite, cyrs., bbl., lb.	.02½– .02½	.02½– .02½	.02½– .02½
Sulphur, crude at mine, bulk, ton	18.00 –	18.00 –	18.00 –
Chloride, dr., lb.	.03½– .04	.03½– .04	.03½– .04
Dioxide, cyl., lb.	.06½– .08	.06½– .08	.07 – .07½
Flour, bag, cwt.	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb.	.47 –	.47 –	.55 –
Crystals, bbl., lb.	.34 –	.34 –	.39 –
Zinc, chloride, gran., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb.	.09 – .11	.09 – .11	.09 – .11
Cyanide, dr., lb.	.36 – .38	.36 – .38	.36 – .38
Dust, bbl., lb.	.068– .07	.068– .07	.066– .07
Zinc oxide, lead free, bag., lb.	.05 –	.05 –	.05½–
5% lead sulphate, bags, lb.	.04½–	.04½–	.05½–
Sulphate, bbl., cwt.	2.65 – 3.00	2.65 – 3.00	2.75 – 3.00

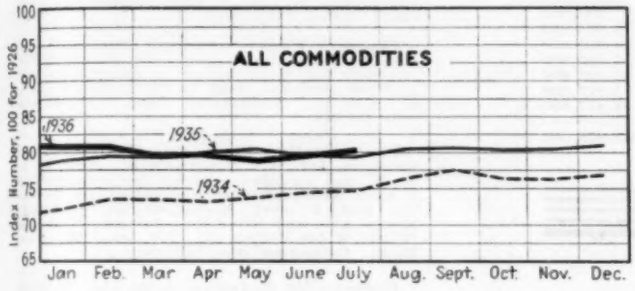
Oils and Fats

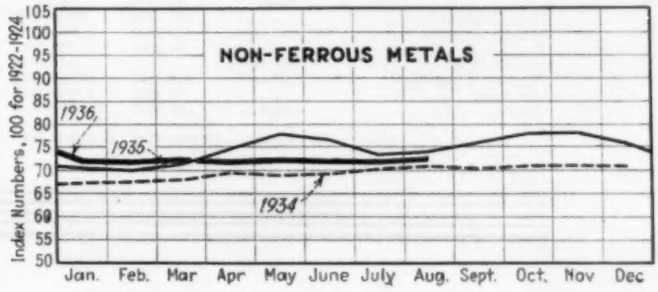
	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.10 –$0.11	$0.10 –$0.11	$0.09½–$0.10
Chinawood oil, bbl., lb.	.14½–	.16 –	.22 –
Coconut oil, Ceylon, tanks, N. Y. lb.	.06 –	.04½–	.04 –
Corn oil crude, tanks, (f.o.b. mill), lb.	.09½–	.09½–	.09½–
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.09½–	.08½–	.09 –
Linseed oil, raw car lots, bbl., lb.	.10½–	.10⅜–	.083–
Palm, casks, lb.	.05 –	.04½–	.04½–
Palm kernel, bbl., lb.	.05½–	.05½–	.05½–
Peanut oil, crude, tanks (mill), lb.	.09½–	.09 –	.09½–
Rapeseed oil, refined, bbl., gal.	.65 –	.65 –	.45 –
Soya bean, tank, lb.	.08½–	.08½–	.08½–
Sulphur (olive foots), bbl., lb.	.09½–	.08½–	.08 –
Cod, Newfoundland, bbl. gal.	.43 –	.43 –	.35 –
Menhaden, light pressed, bbl., lb.	.068–	.072–	.065–
Crude, tanks (f.o.b.factory), gal.	.30 –	.30 –	.28 –
Grease, yellow, loose, lb.	.06½–	.05½–	.05½–
Oleo stearine, lb.	.10½–	.10½–	.12 –
Red oil, distilled, d.p. bbl., lb.	.09½–	.09½–	.09½–
Tallow, extra, loose, lb.	.06½–	.06 –	.06½–

CHEM. & MET.'S WEIGHTED PRICE INDEXES









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude, bbl., lb.	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.62
Refined, bbl., lb.	.80 – .85	.80 – .85	.80 – .85
Alpha-napthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.14½– .15	.14½– .15	.14½– .15
Aniline salts, bbl., lb.	.24 – .25	.24 – .25	.24 – .52
Benzaldehyde, U.S.P., dr., lb.	1.10 – 1.25	1.10 – 1.25	1.10 – 1.25
Benzidine base, bbl., lb.	.65 – .67	.65 – .67	.65 – .67
Benzoic acid, U.S.P., kgs., lb.	.48 – .52	.48 – .52	.48 – .52
Benzyl chloride, tech., dr., lb.	.30 – .35	.30 – .35	.30 – .35
Benzol, 90%, tanks, works, gal.	.16 – .18	.18 – .20	.15 – .16
Beta-napthol, tech., drums, lb.	.24 – .27	.24 – .27	.22 – .24
Cresol, U.S.P., dr., lb.	.10 – .11	.10 – .11	.11 – .11½
Cresylic acid, 99%, dr., wks., gal.	.73 – .75	.73 – .75	.45 – .46
Diethylaniline, dr., lb.	.55 – .58	.55 – .58	.55 – .58
Dinitrophenol, bbl., lb.	.29 – .30	.29 – .30	.29 – .30
Dinitrotoluen, bbl., lb.	.16 – .17	.16 – .17	.16 – .17
Dip oil, 25%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, bbl., lb.	.38 – .40	.38 – .40	.38 – .40
H-acid, bbl., lb.	.65 – .70	.65 – .70	.65 – .70
Napthalene, flake, bbl., lb.	.07½– .07½	.07 – .07½	.05½– .06
Nitrobenzene, dr., lb.	.08½– .09	.08½– .09	.08½– .10
Para-nitraniline, bbl., lb.	.51 – .55	.51 – .55	.51 – .55
Phenol, U.S.P., drums, lb.	.14½– .15	.14½– .15	.14½– .15
Picric acid, bbl., lb.	.30 – .40	.30 – .40	.30 – .40
Pyridine, dr., gal.	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Resorcinal, tech., kegs, lb.	.65 – .70	.65 – .70	.65 – .70
Salicylic acid, tech., bbl., lb.	.40 – .42	.40 – .42	.40 – .42
Solvent naptha, w.w., tanks, gal.	.26 –.....	.26 –.....	.26 –.....
Tolidine, bbl., lb.	.88 – .90	.88 – .90	.88 – .90
Toluene, tanks, works, gal.	.30 –.....	.30 –.....	.30 –.....
Xylene, com., tanks, gal.	.30 –.....	.30 –.....	.30 –.....

Miscellaneous

	Current Price	Last Mont	Last Year
Barytes, grid., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb.	.17½– .18½	.17 – .18	.11 – .13
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04 – .29	.04 – .20	.04 – .20
Prussian blue, bbl., lb.	.37 – .38	.37 – .38	.36½– .37
Ultramarine blue, bbl., lb.	.10 – .26	.10 – .26	.06 – .32
Chrome green, bbl., lb.	.26 – .27	.26 – .27	.26 – .27
Carmine red, tins, lb.	4.00 – 4.40	4.00 – 4.40	4.00 – 4.40
Para toner, lb.	.80 – .85	.80 – .85	.80 – .85
Vermilion, English, bbl., lb.	1.59 – 1.60	1.59 – 1.60	1.52 – 1.56
Chrome yellow, C. P., bbl., lb.	.12 – .14	.12 – .14	.15 – .15½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 – .08½	.07 – .08½	.07 – .08½
Gum copal Congo, bags, lb.	.09 – .10	.09 – .10	.09 – .10
Manila, bags, lb.	.09 – .10	.09 – .10	.16 – .17
Damar, Batavia, cases, lb.	.13½– .16	.15½– .16	.15½– .16
Kauri No. 1 cases, lb.	.19 – .25	.20 – .25	.20 – .25
Kieselguhr (f.o.b. N. Y.), ton.	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc, ton.	50.00 –.....	50.00 –.....	50.00 –.....
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	.03 – .40	.03 – .40	.03 – .35
Rosin, H., bbl.	7 25 –.....	7.35 –.....	5.30 –.....
Turpentine, gal.	.42½–.....	.44 –.....	.44½–.....
Shellac, orange, fine, bags, lb.	.25 –.....	.25 –.....	.25 –.....
Bleached, bonedry, bags, lb.	.18 –.....	.18 –.....	.21 –.....
T. N. bags, lb.	.14½–.....	.14½–.....	.14 –.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 –10.00	7.50 –10.00	7.50 –11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 –.....	13.75 –.....	13.75 –.....

INDUSTRIAL NOTES

MAGNETIC MFG. CO., Milwaukee, Wis., has changed its name to Stearns Magnetic Mfg. Co. The change was made to identify the products of the company more closely with its trademark name.

EDGE MOOR IRON WORKS, Edge Moor, Del., a new company capitalized at $1,000,000, has taken over in its entirety, the Edge Moor Iron Co. Thomas J. Dillon is president and manager.

LINCOLN ELECTRIC CO., Cleveland, has moved its office in San Francisco to 866 Folsom St. L. P. Henderson is local manager.

THE W. W. SLY MFG. CO., Cleveland, has appointed Alexander Haigh, 141 Milk St., Boston, as its representative in New England.

BINNEY & SMITH CO., New York, has placed its sales agency for carbon black for Kansas, Nebraska, and Oklahoma, in the hands of the Abner Hood Chemical Co., Kansas City, Mo.

REYNOLDS MOLDED PLASTICS, Jackson, Mich., has opened a sales office at 90 West St., New York. Herbert S. Reynolds, Jr., is in charge.

ALLIED INDUSTRIAL ALCOHOL CO., New York, has appointed the Arthur C. Trask Co., sales agents for the Chicago territory.

DEEPWATER CHEMICAL CO., Los Angeles, Calif., has appointed the Mefford Chemical Co., of the same city distributor for iodine and products recovered from waste waters in the oil wells of Southern California.

GLYCO PRODUCTS CO., INC., has appointed sales representatives in Buffalo, N. Y., Houston, Texas, Rochester, N. Y., Akron, Ohio, and Cleveland, Ohio. The company also will have new representatives in Canada at Toronto, Montreal, Vancouver, and at Johannesburg, South Africa.

New CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative 1936	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$37,000	$463,000	$990,000
Middle Atlantic	$2,552,000	824,000	9,646,000	9,988,000
South	.....	74,000	11,708,000	14,432,000
Middle West	1,007,000	.....	7,544,000	7,349,000
West of Mississippi	150,000	926,000	6,308,000	8,002,000
Far West	.....	74,000	4,080,000	5,877,000
Canada	655,000	100,000	14,160,000	8,437,000
Total	$4,364,000	$2,035,000	$53,909,000	$55,075,000

PROPOSED WORK
BIDS ASKED

Biological Laboratory—Swarthmore College, Swarthmore, Pa., received from Fred M. Kirby, Wilkes-Barre, Pa., a gift of $200,000 and will construct a new biological laboratory as a memorial to Dr. Edward Martin, former Professor at Swarthmore College.

Brick and Fire Clay Factory—Kilgard Firebrick Co., Ltd., 2521 Maple St., Vancouver, B. C., Can., plans construction of plant for manufacture of brick, fire clay, tiles, pipes, pottery, etc. Estimated cost $50,000.

Carbide Plant—The Union Carbide Co., 137-47th St., Niagara Falls, N. Y., and 30 East 42nd St., New York, N. Y., soon lets contract for constructing 1 story, 90x360 ft. brick, steel, concrete furnace room, 80x180 ft. mixing department building and 35x180 ft. car shed. Estimated cost exceeds $100,000.

Chemical Plant—Howard Smith Paper Co., Ltd., 407 McGill St., Montreal, Que., Can., plans to construct a chemical plant at Smithville, Ont. Estimated cost $75,000.

Compressor Station — Keystone Gas Co., Chartiers Twp., Washington County, Pa., plans rebuilding compressor station near Cannonsburg, Pa., destroyed by fire. Estimated cost $75,000.

Cotton Oil Mill—Southern Cotton Oil Company, c/o Chamber of Commerce, C. C. Williams, Harlingen, Tex., plans construction of cotton oil mill, north of Valley Refining Co. plant on Southern Pacific Railway tracks, products of which will be cotton seed meal, cotton seed oil and other by-products. Machinery will include four hydraulic and six cold presses. Estimated cost $150,000.

Enamel Plant—Pittsburgh Plate Glass Co., Milwaukee, Wisc., plans to construct 4 story, 60x220 ft. enamel plant on East Pittsburgh St. Eschweiler & Eschweiler, Milwaukee, Archts.

Factory—Linde Air Products Co., 205 East 42nd St., New York, N. Y., plans constructing factory buildings on Military Rd., Tonawanda, N. Y. S. R. Donelion, c/o owners, is in full charge of construction. Estimated cost $2,000,000.

Pharmaceutical Plant—W. S. Merrell Co., C. G. Merrell, Pres., Cincinnati, O., plans constructing new pharmaceutical manufacturing plant on Amity Rd. Tietig & Lee, 34 West 6th St., Cincinnati, Archts. Estimated cost $800,000.

Paint Factory — Carnett Paint Co., Ltd., Kurt Heydenreich, Mgr., 5838 Fourth Ave., Montreal, Que., Can., plans to construct a factory. Estimated cost $40,000.

Paper Mill—Abitibi Paper Co., Ltd., Fort William, Ont., Can., plans reconditioning paper mill. Estimated cost $100,000.

Pulp Mill—Point Ellice Lumber Co., Ltd., 2516 Pleasant St., Victoria, B. C., Can., plans to construct a pulp mill, saw and shingle mills. Estimated cost $50,000.

Refinery — Battleford Ellison Oil Development & Refinery Co., Ltd., Battleford, Sask., Can., plans to construct a refinery. Estimated cost $100,000.

Oil Development—Messer Oil Co., Olean, N. Y., J. H. Messer, Mgr., plans development of oil producing property in town of Alma, Allegany County, to include drilling about forty 1700 ft. wells and constructing modern pressure plant to force recovery of crude oil from sand. Estimated cost exceeds $40,000.

Oil Refinery—Consumers Oil Refinery, Ltd., 789 West Pender St., Vancouver, B. C., Can., plans oil development involving an expenditure of $100,000.

Refinery—International Bitumen Co., Edmonton, Alta., Can., plans to construct a 700 bbl. refinery at the tar sands deposits 50 miles north of Fort McMurray on the Athabasca River. H. F. Everard, Engr. Initial cost, $100,000.

Research Building—Jones & Laughlin Steel Co., 3rd and Ross Sts., Pittsburgh, Pa., will construct one story research building along Monongahela River. C. W. Littler, Ch. Engr. Estimated cost $100,000.

Silica Plant—Huron River Silica Co., 912 Dime Bank Bldg., Detroit, Mich., plans construction of 1 and 2 story brick, steel and concrete plant for mining silica for glass manufacturing purposes along Detroit and Toledo R. R. at South Rockwood, Mich. Estimated cost $170,000.

Silk Mill—The Vaucanson Silk Mills, Inc., 200 East Main St., Port Jervis, N. Y., plans addition to dye factory and will take bids at once on general contract. Estimated cost including equipment $37,000.

Shipping Shed — Great Lakes Paper Co., Ltd., Fort William, Ont., Can., plans the construction of a shipping shed. Estimated cost $40,000.

Beet Sugar Factory — Corporation, c/o Joseph Ferbeck, Engineer, 7415 Sherbrooke St., Montreal, Que., Can., plans to construct sugar beet plant with capacity of 1200 tons of beets per day and by-products of dried beet pulp, alcohol, yeast, glycerine and fertilizer, at Winnipeg, Man. Estimated cost $250,000.

Sugar Refinery—Holly Sugar Corp., Colorado Springs, Colo., plans to build a 1,500 ton capacity sugar factory at Hardin, Mont. Estimated cost $1,500,000.

Sugar Refinery — Spreckels Sugar Co., 2 Pine St., San Francisco, Calif., is receiving bids for principal buildings to be constructed at sugar refinery at Woodland, Calif.

Sugar Refinery—Utah-Idaho Sugar Co., Marietta Rd., Bellingham, Wash., plans constructing a refinery covering 10 acres and processing 1500 tons of beets a day, electrically operated and employing 250 men, at Toppenish, Wash.

CONTRACTS AWARDED

Batch House—Pittsburgh Plate Glass Co., Pittsburgh, Pa., has awarded contract for constructing batch house and six silos at Clarksburg, W. Va., to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa.

Chemical Plant—Naugatuck Chemical Co., Elm St., Naugatuck, Conn., has awarded the contract for constructing 1 story additions to brick chemical plant to W. J. Megin, Inc., 51 Elm St., Naugatuck, Conn. Estimated cost $37,000.

Pharmaceutical Plant—Ciba Pharmaceutical Products, Inc., 627 Greenwich St., New York, N. Y., has awarded contract for constructing 3 story administration and laboratory building and 3 story manufacturing building, Morris Ave. and River Rd., Summit, N. J., to Walter Kidde Constr. Co., 140 Cedar St., New York. Estimated cost $500,000.

Factory—Air Reduction Sales Co., 60 East 42nd St., New York, N. Y., and 730 Grant St., Buffalo, N. Y., is building a factory. Work is being done by separate contracts. J. R. Wolf, c/o owner, is in charge.

Factory—Davison Chemical Co., Curtis Bay, Baltimore, Md., has awarded contract for 1 story, 40x120 wash room building to Engineering Contracting Co., North and Linden Aves., Baltimore, Md. Estimated cost $35,000.

Factory—Defender Photo Supply Co., 666 Driving Park Ave., Rochester, N. Y., has awarded contract for factory to Frank Maggio & Bros., 374 Augustine St., Rochester, N. Y. Estimated cost will exceed $40,000.

Industrial—E. I. du Pont de Nemours & Co., has awarded contract for constructing 3 story mezzanine industrial building on Grey Ferry Rd., Philadelphia, Pa., to Turner Constr. Co., Architects Bldg., Philadelphia. Estimated cost $175,000

Laboratory—Canadian Industries, Ltd., 1135 Beaver Hall Hill, Montreal, Que., Can., has awarded the contract for constructing addition to their laboratory and fertilizer plant at Beloeil, Que., to Anglin-Norcross, Ltd., 892 Sherbrooke St., W., Montreal, Que., Can. Estimated cost $100,000.

Oil Refinery — Gulf Refining Co., Wickett, Tex., has awarded contract for construction of a refinery to Broun Construction Co., Los Angeles, Calif. Estimated cost $426,000.

Oil Refinery—Northwest Refining Co., Cut Bank, Mont., will build refinery and tank farm with daily capacity of 25,000 barrels. Work will be done by force account. Estimated cost $500,000.

Paper Mill—Sonoco Products, Inc., North Ave., Westfield, N. J., has awarded contract for 1 story, 80x150 ft. paper mill in Garwood, N. J., to Mahony Troast Construction Co., 657 Main Ave., Passaic, N. J.

Textile Laboratory — West Point Manufacturing Co., West Point, Ga., will construct laboratory. Work will be done by separate contracts. Estimated cost to exceed $37,000.

Warehouse — Amalgamated Sugar Co., Ogden, Utah, will soon award contract, for construction of 25x106 ft. brick warehouse and loading dock. Estimated cost $35,000.

Warehouse—Fibreboard Products Co., Inc., Montgomery and Francisco Sts., San Francisco, Calif., has awarded the contract for constructing a 1 story warehouse to Lindgren & Swinerton, 225 Bush St., San Francisco. Estimated cost $38,500.